IOWA COLLEGE
CHRISTO DUCE
LIBRARY, 1848

THE

AMERICAN NATURALIST

VOL. XXXI. February, 1897. 362

NOCTURNAL PROTECTIVE COLORATION OF MAMMALS, BIRDS, FISHES, INSECTS, ETC.

BY A. E. VERRILL.[1]

Although much has been written regarding the protective and imitative colors and forms of various animals, as seen by daylight, very little attention has been paid to their protective colors as seen by moonlight, twilight, and starlight, when large numbers of species of small mammals and fishes, and numerous insects are most active in search of food and most of the large carnivorous and insectivorous species are abroad in search of their prey. Moreover most birds and many fishes and insects sleep in exposed situations and are thus subject to the attacks of nocturnal predaceous species. The latter, in turn, need protective colors for the night-time, in order to avoid the notice of their prey. One of the most evident effects of moonlight or starlight is to give very black shadows. In the case of bright moonlight these black shadows of trees, etc., may be broken up by patches of white moonlight. Therefore, black or dark-brown animals are nearly invisible in such shadows. If black animals have patches of white or light yellow these will serve a useful purpose by breaking up and obscuring the outlines of bird or beast and look like patches of moonlight on a shadow.

[1] (Abstract of a paper read before the Morphological Society. Dec. 30, 1896.)

Accordingly we find many nocturnal carnivorous mammals that are black (*e. g.*, minks, fisher, bears) and some that are black and white. We also find numerous black, as well as black and white, birds, insects, etc., whose colors can best be explained as due to the influence of natural selection among protective nocturnal colors. The dark gray and brownish-gray colors so common among small nocturnal mammals, like mice, arvicolæ, moles, shrews, marsupials, etc., are highly protective at night. Even when these creatures are running about among green grass and weeds they are scarcely visible in a feeble light. Such colors are not at all protective in the day time, in such places. Moreover, such mammals usually hide in holes or crevices in the day time, where the color does not matter.

Most nocturnal black, brown, and dark gray insects, like the ground beetles, crickets, ants, etc., unquestionably find protection in these colors, though they are conspicuous in the day time. Among diurnal birds and insects there are, also, many cases of conspicuous and bright colors that become protective by moonlight and starlight, when these creatures are asleep or quietly resting among foliage or flowers, and most exposed to their nocturnal enemies. In general, it may be said that in all cases where black or very dark colors are strongly contrasted with white, yellow, or other light markings, these patterns are more likely to be protective at night than in the day time. Such colors may be due, in many cases, to other causes, but when no special cause for their origin can be found, they are probably due, in most cases, to nocturnal protective value, and this can be definitely ascertained by a study of the nocturnal habits and surroundings.

Many of our native butterflies have bright and conspicuous colors which are the reverse of protective in the daytime, when their acute senses and active habits afford fair protection. But I have observed that at night, when roosting on flowers, their colors so blend with those of the flowers as to render them inconspicuous, even in good moonlight. Many species of *Argynnis* and allied genera are conspicuously marked with red, brown, and orange on the under side of the wings, and have bright silvery spots or blotches in addition, so that they are

conspicuous in the daytime. I have noticed that when these large butterflies are roosting at night on goldenrods and other favorite flowers, with their wings folded up over the back, their colors not only blend with those of the flowers but their silvery spots shine in the moonlight like the dewdrops that surround them.

Many birds, insects, etc., have acquired colors that are equally protective both by day and by night. This is true in the case of the green colors of those that live on or amongst foliage, and in the case of those that have dull gray and brown colors, imitative of the bark of trees on which they rest. It also applies to bright colored insects that live on flowers of the same colors. But the multitudes of cases, which cannot be explained in this way, are probably due to special nocturnal protection.

Many fishes that rest at night amongst the stems of aquatic grasses, sea-weeds, etc., have dark or black stripes crossing the body transversely, obliquely, or longitudinally. Such colors are highly protective at night, when they are most exposed to their predaceous enemies, for the dark bands then resemble the dark stems and shadows of the weeds, and serve admirably to conceal the outline of the fish. Black fins and tails serve a similar purpose. Such markings of fishes are generally more distinctly developed at night than in the day time, as explained in the next article.

In a similar way, the striped colors of the tiger are doubtless more effective for concealment at night, or in the dusk of evening, among the stalks of reeds and shrubs, than in the day time. The same is true of the colors of the spotted jaguar, leopard, etc.

The common raccoon is fairly well protected even in the day time by its gray fur, when resting on the large gray branches of trees, but as it generally hides by day in holes, we must regard its peculiar coloration as due to nocturnal protection, for which it is emniently adapted.

Nocturnal and Diurnal changes in the Colors of Certain Fishes, and of the Squid (Loligo), with notes on their Sleeping Habits. —These observations were mostly made in the U. S. Fish Commission Laboratory, at Wood's Holl, Mass., in 1885 to 1887, when the laboratory was in excellent condition for biological studies. In order to observe the nocturnal habits of the fishes, etc., in the aquaria, the gas was turned down low, so as to give a light just sufficient for distinct vision, after every one except myself had retired. Great care was also taken not to jar the floor or furniture. Under these conditions many interesting observations were made. It was noticed that while many species became very active others took this opportunity to sleep, and in doing so, assumed unusual colors and positions. Several species of fishes, while asleep, had colors very different from those seen in the day time. Others showed a decided increase in the intensity or contrast of their colors, without changing the pattern. The latter was the more common habit, and was noticed especially in the case of species that have longitudinal, transverse, or oblique dark bands or stripes or irregular mottlings. As previously explained, these dark stripes are highly protective colors for fishes that rest at night among weeds and grasses. Among those showing this change are several species of minnows (*Fundulus*), and the king-fish (*Menticirrus nebulosus*), in which the blackish stripes come out more strongly and clearly when asleep than when awake. The black sea-bass, (*Serranus furvus*), especially when young, shows its black markings more clearly when asleep. The sea robins (*Prionotus palmipes* and *P. evolans*), and various species of flounders show more strongly contrasted and darker colors than in the day time. But the scup or porgy (*Stenotomus chrysops*) shows much more remarkable changes in color. This fish, in the day time, usually has a bright silvery color, with a brilliant pearly iridescence, but at night, while asleep, it becomes dull bronzy or gray, and is crossed by about six transverse black bands, colors very effective for concealment among the stalks of eel-grass or sea-weeds. If aroused by suddenly turning up the gas, it immediately resumes its day time colors. If killed in alcohol this fish, and many others, as well as the

squids, usually taken on their nocturnal colors, though these generally soon fade out.

A species of file-fish (*Monacanthus*) which has, in the day time, mottled olive-green and brown colors, with slightly darker fins and tail, when sleeping becomes pallid gray, or nearly white, and the fins and tail become black. This and other related species took curious positions while asleep, often leaning up obliquely, with the back against the glass of the aquaria and the abdomen resting on the bottom; sometimes, also, leaning up in a corner of the aquarium with the body curved, or against stones in similar attitudes.

The tautog or black fish (*Tautoga onitis*) usually sleeps on one side, resting under the edges of rocks, or half buried in sand or gravel, much after the manner of flounders. They often had their bodies variously bent. This fish did not show any marked change of colors, but its ordinary dark colors are nocturnally protective.

The common squid, when resting quietly on the bottom, late at night, and apparently asleep, takes on its darkest colors, due to the full expansion of the brown and purple chromatophores, so that the color is much like that developed when excited in the day time, and similar to the usual color of alcoholic specimens. When swimming quietly in the day time the usual color is pallid or translucent bluish-white, with very small, scattered, dark specks, due to the strongly contracted chromatophores. It takes this color, also, when resting upon the light sandy bottoms, waiting for the approach of the small fishes on which it feeds. It has the power of changing its colors at will, but its nocturnal color is probably automatic and protective.

THE INFERIOR BOUNDARY OF THE QUATERNARY ERA.

By Oscar H. Hershey.

The great diversity of physical conditions of the earth's surface in the Quaternary era of its geological history, has been conducive to much legitimate difference of opinion among students as to the most natural boundaries of the era. A few consider it proper to commence it at the opening of deposition of the now well known Lafayette formation. A few others, the writer included, would date it from the close of the Lafayette epoch of aggradation in the coastal plain and Mississippi embayment regions. But the larger number of geologists are accustomed to refer its beginning only as far back as the first marked extension of land ice in North America and Europe, namely, to the opening of the Kansan epoch. It is the purpose of this paper to defend, if possible, the intermediate proposition.

The Quaternary era, as limited by many geologists, was characterized by a great extension of land ice in the form of broad *névés* passing into and bordered by vast glaciers. As known from their effects, these masses of glacial ice were of great extent, covering at their maximum expansion millions of square miles of the northern temperate zone, and having great development on other parts of the earth's surface, notably in the southern portion of South America, and on nearly all high mountain ranges even under the equator. But between the several maxima of cold, producing and in part produced by these glaciers, there seem to have been climatic periods of comparative mildness. These are commonly known as interglacial epochs because the deposits which belong to them are frequently found interbedded with those which are due to direct ice action, and also because they separated the several epochs whose most characteristic condition was glaciation. But the interglacial epochs were longer than the alternate glacial epochs, so that in point of time, the Quaternary

era, even considered as synonymous with the term, "The Ice Age," did not have glaciation as its predominating condition. In the light of modern discoveries in the later geologic history of Europe and America, the "Glacial period" becomes more figurative than real. Glaciation was the most remarkable and the most prominent feature of the Quaternary era, but its importance was not so great as to overshadow the claims of other natural conditions to the right of constituting the essential elements in the definition and limitation of the era.

It is the opinion of the present writer that the era whose early boundary is under discussion, was naturally set apart from all preceding time by a difference in climate, and to a less marked extent by a difference in fauna and flora; not so much by new species of animals and plants as by a different distribution of them. Just as the present climate differs from that of the Tertiaries so also differed the general Quaternary climate therefrom. We are, in fact, probably living under the normal conditions of the Quaternary era; at least there is no very important difference between the interglacial floral and faunal remains and those of the present time. But all of the various lines of research into the conditions prevalent in the Tertiary era, combine to demonstrate that its climate, in any given geographic district, was somewhat milder than in the same locality at the present time. It is the time of change from the mild Tertiary climate to the somewhat colder Quaternary climate that I would consider as the most natural and, therefore, the most convenient divisional line between the two eras.

In endeavoring to fix this time of climatic transition by means of the effects produced, we are confronted by the imperfection of the geological record. A large part of the interval between the time of pronounced Tertiary mildness and early Quaternary severity, was occupied by conditions not favoring the preservation of organic remains, namely, by an elevated condition of the land and rapid erosion. Hence, we are reduced to the necessity of theoretically deducing the most probable cause of such a general change in climate, and then endeavoring to fix by evidence, if possible, the time when said cause or causes came into operation.

The general climate of any portion of the earth's surface is determined by latitude, i. e., by the amount of heat received from the sun. But there are other influences which combine to modify the climate of any given locality. The most important are the extent and position of the bodies of land, the heighth and trend of mountain ranges, and the relation between ocean and air currents. If all these conditions remain unchanged for a very long period, no great diversity of climate will effect the locality. But any disturbing influence, destroying the relations between the conditions mentioned must, *in rerum naturæ*, effect the climate of the entire earth to a certain extent. Of strictly terrestrial causes there are none so potent to bring about this result as great earth movements, changing the relation between the continents and seas, thus modifying the ocean currents, and by presenting barriers in the form of high mountain ranges, interfering with the courses of the prevailing winds. In view of the fact that astronomical causes of the changes of geologic climates are not capable of practical demonstration, while the terrestrial or land movement theory not only is capable of such proof, but already such evidence has been collected to indicate at least a time relation between the main land disturbances and the most important climatic changes, I shall consider only the latter hypothesis in the present discussion.

If the peninsula of Florida were uplifted several thousand feet into a high narrow plateau, and then dissevered by the erosion of deep valleys into separate mountain peaks and ridges, the present warm temperate and subtropical flora and fauna would largely disappear. With the production of a rocky sea-cliff about its borders and the destruction of the swamps and marshes, the palmetto and alligator, each the most characteristic portion of the Floridian flora and fauna, would be eliminated; forced to migrate or become extinct. With them would go the destruction of many other animals and plants. The geologist who would make a study of the region one million years hence, would find such a great contrast in the fossil remains enclosed in the strata laid down near the coast now and those after the uplift, that he would be con-

strained to refer them to separate periods in his geologic classification. Yet the climate and natural history conditions of the rest of the earth's surface may have remained unchanged, so that his divisions, based on the changes in Florida, would be of merely local significance.

But if the uplift, instead of being confined to the peninsula of Florida, were of continental extent, its effects would be far reaching and very important. With the extension of the land area, there would be an increase of the distinctly interior portion of the continent, whose climate, slightly different from that of the coasts, would have an appreciable effect on the flora and land fauna of the present coastal regions. The elevation of the continent, also, would lower the general temperature throughout its extent, driving southward the present north border of various temperate species of trees and other plants, and so changing the facies of the flora in any given locality. Such elevation of a very extensive land area, if thousands of feet in height, would have some effect on the climate of the entire earth, although just what this effect would be would depend largely upon the situation of the uplifted land with relation to the prevailing winds and ocean currents. But the most important manner in which the uplift would effect the natural history of the continent would be through radical changes of its soil and physical features. The low-lying, somewhat swampy plain, with its deep soil resulting from a long accumulation of the products of secular decay, would give place to a sharply dissected plateau, the steep hill sides and narrow crests of its individual ridges covered but thinly with a stony soil. While the effect upon the flora and fauna of any one change in conditions would probably be comparatively slight, the combined effect of all must be considerable, even if the uplift be but little. Indeed, it seems evident that not even the least change in the relation between land and sea can occur without somehow effecting the climate, and through it the life characters of the region in movement.

In an article entitled "The Relation between Baseleveling and Organic Evolution,[1] J. B. Woodworth discusses "the effect,

[1] American Geologist, Vol. XIV, No. 4, October, 1894.

on organisms, of the changes in physical geography which arise in the process of baseleveling." One of his most important conclusions is that the great change at the close of the Mesozoic era, from a characteristically reptilian to an equally characteristic mammalian land fauna, was due primarily to the great change in the physical features of the continent which is known to have closed the Cretaceous and introduced the Eocene period. The low-lying denudation plain of the later Mesozoic era was rapidly changed into the more elevated hilly land surface of the early Tertiary era. Toward the closing stages of Tertiary time, a peneplain had again been formed over a large portion of the continent, but it was not so perfect nor so extended as the previous one, and, hence, its effect upon organic life was less marked.

The main Tertiary or Tennesseean period of base-leveling in the eastern portion of North America was terminated by a slight seaward tilting of the continental plateau. A portion of the former land area was depressed beneath the sea, and on it was laid down a marine formation of red and orange gravelly loam—the Lafayette formation. The land on the alternative side of the axis of general deformation was slightly uplifted, thereby stimulating the streams to greater activity, which carried the products of rock disintegration into the neighboring sea to form the Lafayette formation. The soil and subsoil of the land area of that time were prevailingly of a red color, for had it been otherwise the Lafayette formation would not be so generally of that tint. Red soils are characteristic of lands whose climate is comparatively mild. The soils of the central and upper Mississippi basin, from whence chiefly was derived the red Lafayette loam of the Mississippi embayment region, are not known to have been of a decided reddish tint in the Quaternary era, except locally during the mild Aftonian interglacial epoch. On the contrary, the colors which almost exclusively dominate the deposits and buried soils of the Quaternary era are blue, yellow, brown and black. The fineness of the materials introduced by glaciation, the broad swampy flats, and the usually severe winter climate were the combined causes of the dark color of the Quaternary

soils. None of these conditions were present in any marked degree during the Lafayette period, as the color and composition of the marine deposits and interior river gravels positively demonstrate.

The causes which produced glaciation not yet having begun to operate on the continent, the extension of the warm gulf waters to the head of the Mississippi embayment and the borders of the southern Appalachian province, must have introduced a milder climate into the upper and central portions of the Mississippi basin, providing no counteracting influences were brought to bear. The probable slight elevation of the continent northward from the Lafayette coast certainly did not possess sufficient power to modify the climate to any appreciable extent. Therefore, it seems evident that any change of climate in the eastern half of the territory now included in the United States, which may have accompanied the opening and culminating stages of the Lafayette epoch, must have been in the nature of increasing mildness instead of an increase in the severity of the climate. In short, so far as the climate is concerned, all the evidence which is at present known to exist is demonstrative of the practical continuance of Tertiary conditions to the close of the Lafayette epoch. Hence, those geologists who wish to include the Lafayette epoch under the Quaternary era, must base their claims on some other natural feature than climate. Mere earth movement, if its effects are not prominent, cannot be considered as instituting a new era, and, as the elevation of any part of America or the world at large in the Lafayette epoch is not known to have been great in vertical extent, and to have seriously effected climates, it can hardly constitute a legitimate reason for placing the epoch in the Quaternary era.

Immediately following the close of the Lafayette epoch there was a period of pronounced elevation of the continent. This is indicated by the valleys which have been eroded beneath the surface of the Lafayette deposits, by the great depth of the coastal valleys now submerged to form the fiords of the coasts of British America, Alaska, Scotland, Norway, Patagonia and other portions of the earth's land area; and no less truly

though less definitely by the cañon valleys of the interior portions of the North American continent. The period of high-level continued to the opening of the Kansan epoch of glaciation, when, through some cause not rightly understood, but probably largely the great weight of the accumulating ice-sheet, the land in the eastern half of North America was depressed, and has remained to the present time at a much lower altitude than before the Kansan epoch. The high-level period or epoch just mentioned, seems naturally set apart both from the preceding low-level Lafayette epoch and the succeeding low-level Glacial epochs. It has, therefore, been defined as a geologic time unit and designated the Ozarkian epoch, from the fact that its results are so well seen in the sharp cut cañon valleys of the Ozark mountain and plateau regions of southern Missouri and northern Arkansas.

Although commonly considered as a unit, the Ozarkian high-level epoch was probably characterized by two main elevatory movements. The first began and ended at and very soon after the opening of the epoch, and was of great areal extent but not very marked vertical movement. To it, however, may be traced nearly all the recognized effects of the Ozarkian high-level condition of eastern North America. The second decided disturbance of the earth's equilibrium seems to have occurred very nearly at the end of the epoch. It was somewhat local in nature and effected most the northeastern portion of America, (and probably all the lands surrounding the North Atlantic). I must acknowledge that I am basing my claims for this elevatory movement on somewhat slender evidence. But the deep, narrow, now submerged valley channels in the border portions of the continental plateau off the mouths of such rivers as the Delaware and Hudson, certainly were not in process of excavation during the whole or even any large part of the Ozarkian epoch. They must be the result of a special elevation near the close of the epoch. And, further, the cañon valleys of the Mississippi basin sometimes have rock shelves buried under the present valley bottom. Often these rock shelves cannot be explained by any inequality of the strata excavated, but seem to indicate a renewed period of up-

lift near the close of the epoch. I may also add that those who, like the present writer, are inclined to find between the preglacial high-level of the eastern part of North America and the immediately succeeding glaciation a relation somewhat like cause and effect, see nothing at all improbable in the idea of a marked, comparatively rapid, local uplift of the regions afterwards glaciated.

The Ozarkian epoch, as already indicated, was terminated by the accumulation of the Kansan ice-sheet and the consequent depression of much of the land formerly elevated. It is here that most geologists wish to open a new era in the earth's geological history. There are, I believe, a number of objections to it. In the first place, glaciation, although effecting millions of square miles, was yet local when the entire land area of the globe is taken into consideration. Beyond the districts actually glaciated, it is often very difficult to accurately locate in a series of "effects" those which are chronologic equivalents of the opening of the Kansan epoch. A marked elevation of wide extent would, by reason of its having an observable effect on the streams of the disturbed area, and thereby modifying to a certain extent the erosion forms produced, be of vastly more utility in establishing a natural classification of time than a local accumulation of land ice. Furthermore, we have no evidence of any great change in climate, and hence in flora and fauna in the unglaciated districts at the opening of the Kansan epoch. Certainly the temperate species of animals and plants were driven away from the near vicinity of the ice, but to what distance we cannot say. Indeed, there is no probability that the change in the natural history conditions of regions not close to the great Quaternary glaciers at the opening of the Kansan epoch, was nearly as radical as that which must have resulted upon the withdrawal of the sea to beyond the present coasts and the general continental uplift and peneplain dissection which characterized the early stages of the Ozarkian epoch. If change of climate, of the physical features of continents, and of the geographic distribution of faunas and floras be accepted as the prime essentials in establishing a new era, the opening

of the Ozarkian epoch has superior claims over the opening of the Kansan epoch.

The great geological eras are demarked by widespread unconformities and a radical change in sediment. As every effect has had a cause adequate to produce it, it may be assumed that these breaks in the sedimentary series were correlated with and directly dependent upon great changes of the land areas, usually of continental and often of almost world-wide extent. These changes were of the nature of great earth pulsations, uplifting and depressing the continental plateaux, and, when the contraction of the earth's crust was very severe, corrugating it and even, at times, fracturing it along certain lines of weakness. The new geological era thus instituted is usually considered to date from the time that the disturbance first assumed prominence, modifying the flora and fauna of the land areas and the nature of the sediment deposited in the sea about their borders. In short, it may be considered a rule that the natural opening event of the eras previous to the Quaternary as at present constituted, was a profound disturbance of the earth's equilibrium, and it does not seem to the writer that this rule should be set aside in subdividing the later geological history. Therefore, convenience and the need of a classification based strictly upon natural conditions, seem to demand that the Ozarkian epoch should be included under the term Quaternary era.

If we accept the above proposed innovation on the generally accepted scheme of geologic time divisions, we are constrained to reconstruct the previously established Quaternary classification. For it will soon become evident that the time of Ozarkian high-level of the continent deserves more than a mere recognition as an epoch equivalent in significance to any one of the succeeding glacial or interglacial epochs. It was pre-eminently a time of comparatively elevated conditions of the land *without glaciation.* Succeeding it was a period characterized by alternating glacial and non-glacial conditions, rapid epeirogenic movements, repeated migrations of faunas and floras, but no long continued high-level conditions. In point of time the former or Ozarkian period or epoch was by

far the longer. This is graphically illustrated by the vast difference in the amount of valley erosion accomplished during the two periods. Although the glacial epochs are usually considered to have been accompanied by increased precipitation and other favorable conditions for rapid erosion, the valleys then excavated are quite insignificant as compared with the

Quaternary Era	Recent Period		Modern Epoch—Flood plain deposition.
			Terrace Epoch—Valley erosion.
	Pleistocene Period	Glacial division	Wisconsin Epoch—Drift deposition.
			Toronton? Epoch—Valley erosion.
			Iowan Epoch—Drift deposition.
			Aftonian Epoch—Valley erosion.
			Kansan Epoch—Drift deposition.
		Ozarkian division	Ozarkian Epoch—Valley erosion.

Ozarkian valleys. More erosion was accomplished in certain districts during the Aftonian interglacial epoch than during the combined Kansan, Iowa, Toronton? and Wisconsin epochs. Yet the Aftonian rock gorges never approach in size the Ozarkian valleys of the same region. In fact, any one who has studied the Ozarkian valleys of the southern Appalachian, the Ozark and the upper Mississippi regions, and compared them with the results of post-Kansan erosion in such districts as western Illinois and northern Missouri cannot fail to be impressed with the fact that the time which has elapsed between

the close of the Lafayette epoch and the opening of the Kansan epoch was longer than all the time since. If we do not adopt any very large factor of safety, the known evidence will imply a length of time for the Ozarkian period twice and, perhaps, thrice as great as all subsequent time. Therefore, by reason of its length and other features in some respects peculiar to it, the Ozarkian period, or more properly sub-period, may be considered co-ordinate with the Glacial sub-period, the two to constitute approximately equal divisions of the Pleistocene period as in the table on page 113.

THE POCKET, OR POUCHED GOPHER.

(*Geomys bursarius.*)

By Clement L. Webster.[1]

In passing over the beautiful prairies of the west, especially in portions of Iowa and southern Minnesota, the attention of the traveler is arrested by the great number of isolated or grouped mounds, which are seen over the surface.

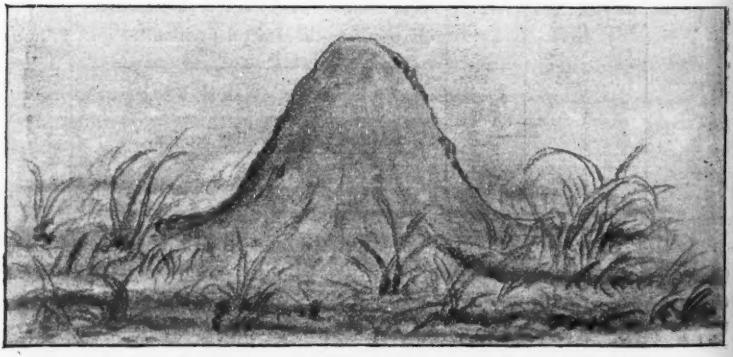
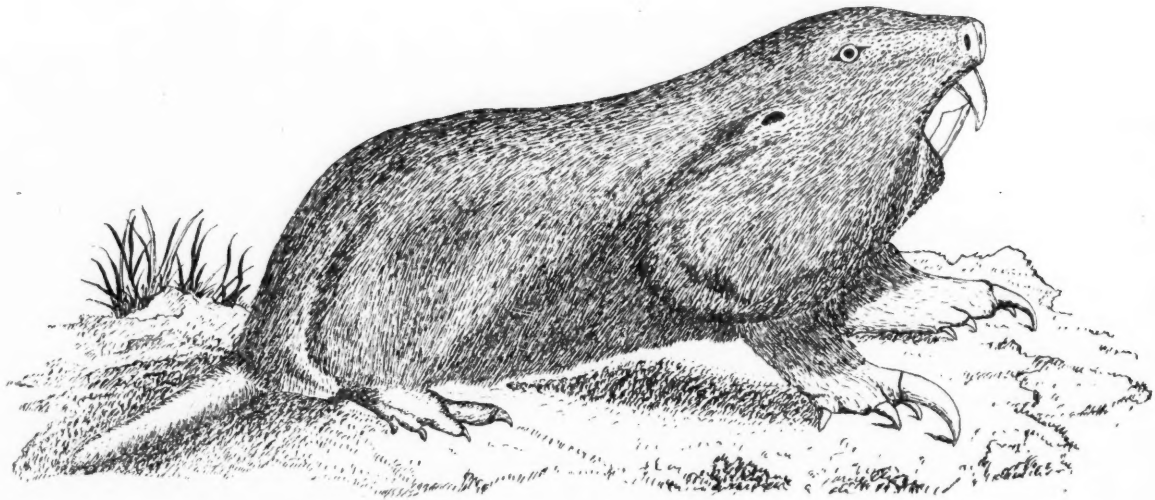


Fig. 1. Geomys bursarius.

These mounds are generally circular, and have a rounded or flattened top; and a diameter, at the base, of from four to twenty feet; and usually rise to a height of from one to three feet.

[1] Charles City, Iowa.

PLATE VI.



Geomys bursarius.

Although the marginal outline of these mounds are usually circular, still, some of them are oblong, or have a gently flowing contour.

These mounds are isolated from five rods to one mile from one another, or are closely and irregularly grouped, or arranged in rude circles, semicircles, or even straight lines.

In some instances, we have counted as many as sixteen of these mounds in an area containing about two acres.

The locations of these mounds are exclusively in the prairie regions, and may be found on either high and dry, or on low and rather moist land. In Iowa and Minnesota, where I have devoted considerable study to these "peculiar mounds," they may be seen for many miles over the level prairies.

By far the greater number of these mounds owe their origin to the Pocket Gopher, (*Geomys bursarius*), which, year by year made additions to them by the dirt brought forth in the extension of their underground channels, until they finally assumed the proportions now seen.

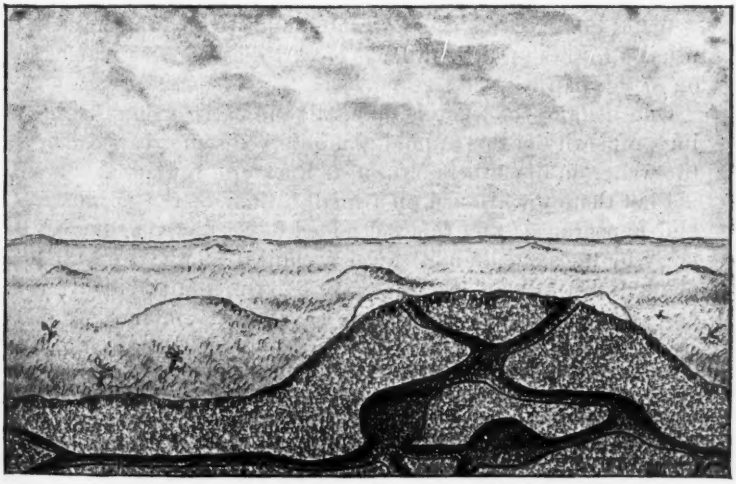


FIG. 2. Geomys bursarius.

Upon the death of the animal, or for some other cause, these mounds, and channels, were finally abandoned, and the

mounds left to be taken possession of by the indigenous plants of the region, which are always, under such circumstances, of much ranker growth than is usual under other conditions.

Although I have been a resident of Iowa for more than twenty-eight years, yet comparatively few of the mounds under consideration have been reared by these Rodents during that time.

The question may arise: If nearly all these structures (which are very numerous) are the works of *Geomys bursarius*, why are there so very few of them in process of erection to-day.

To this query, we conceive of but one or two satisfactory replies; and this is: In the somewhat remote past, this species reached its culmination, or greatest expansion, in the regions under consideration; and that to-day witnesses its final decline; or else, that for an indefinite time in the past, this animal was a resident here, the mounds witnessing to their long abode, and upon the advent of the white settlers and the breaking up of the wild prairie lands, its mound-building propensities, or habits, was, to a considerable extent, modified.

Instead of erecting these great mounds to-day, this animal usually throws up little hillocks of earth, as described farther on in this paper.

One instance of what I may call the early mound-building propensity of this animal, was observed some years ago by the writer on his fathers farm near Rockford, Iowa.

First there was thrown up a small hillock of the usual size and appearance; and this was added to year by year (apparently by the same animal) until a conical mound three and one half feet in height and perhaps five feet in diameter at the base, was reared; when for some cause the animal ceased to work here.

In this instance several small mounds or hillocks were seen in the vicinity.

In fig. 1 is shown a sketch of this conical mound as last seen by the writer.

Some of the early writers on this subject have supposed that the great mounds of the prairies referred to, represent the ruins of ancient "muskrat houses" the builders of which existed

here when the country was far wetter than now—in fact when the country was almost one great "slough."

Others believe them to be the "burial mounds of the Indians;" while still others of these writers attribute their origin to various causes.

In Fig. 2 is given a sectional view (and it conveys a good general idea of internal structure of nearly all of them) of one of these mounds as explored by the writer.

In nearly all cases the old, and sometimes recent, nests of this animal is found in the large expansions of the burrows in the mounds; with sometimes the decayed remains of stored food.

In a few cases it has been found that this animal has in recent times, taken up its abode in these mounds and here reared its young.

In one case, in 1895, near Rockford, Iowa, there was found in one of these mounds what was pronounced to be human bones, by a Physician at Rockford.

As to the correctness of this identification, however, I am unable to state, not having personally examined the relics. If, however, they were undoubted human bones, they then simply represent an intrusive Indian burial here during the early days of the country.

As a general rule, no small hillocks are thrown up by the Pocket Gopher, or seen near, the large mounds herein treated of.

The Pocket Gopher is usually considered a great pest; although not altogether because of the quantity of grain, etc., eaten.

They do not often destroy much grain by eating it, though they not infrequently get into a shock of wheat or barley and eat the heads of a few bundles and cut the bands of many others, and raise little hillocks in the shocks, from seven to fourteen inches in height and ten to twenty inches in diameter.

Considerable damage is done by this animal in gardens, both by eating the vegetables and covering many others with their mounds of earth. "When their holes run through a hill of

potatoes, they always clean out the hill." "Sometimes they do noticeable damage in a patch of potatoes."[2]

The greatest damage done by this Gopher, however, is in covering small grain and grass with the earth they throw from their holes; the injury done in this way, is, in some sections, considerable.

During the latter part of March (1889), I counted, near Rockford, Iowa, ninety hills, from five to nine inches in height and one to three feet in diameter, thrown up by these Gophers in a field of Clover and Timothy. These mounds were all located in an area four by five rods in extent.

Their channels are at times quite straight for some distance; but most usually they frequently bifercate, or are somewhat tortuous.

Little hillocks, averaging from five to eight quarts of earth each, are brought to the surface, along the line of work, at irregular intervals; the distance between them varying from twelve inches to five feet. At other times only a single hillock will be observed in the vicinity; the animal filling the burrow behind him as he pursues his nocturnal way. If any channel be opened, which has even been closed for a long period, it will most usually be filled again very soon, by the Gopher; thus showing that, generally, all the underground galleries are frequently traversed by their inhabitant.

The burial mounds of the prehistoric inhabitants of Iowa, are frequently taken possession of by these Rodents, and the bones of the interred often gnawed; thus giving rise to the supposition, in the minds of some, that this evidences to the cannibalistic habits of the originators of these monuments. This species lays up large stores of food for winter, such as corn, wheat, buckwheat, and other grains, as well as roots and stems of weeds, which are usually cut up into short pieces.

The store of food laid up, is generally much greater than is used. Under straw-stacks, on western farms, where the soil is not frozen, this Gopher sometimes works all winter.

It is stated by Mr. Bailey (*loc. cit.*) that "Pocket Gophers work mostly by night." So far as my personal observations extend,

[2] Vernon Bailey, U. S. Agricultural Report, 1887, p. 448.

however, it is shown that fully as great an amount of work is done by this animal during the day, especially in the early morning, as is done at night.

It is also observed by the same author, that "in the spring many of them leave their holes and travel above ground."[3] In only two cases do I recollect having observed this animal traveling in this way.

In one instance (during an open winter) an individual of this species was found by me traveling through the snow in February. At another time, an individual was observed (during a cold winter) traveling aimlessly about over the deep snows, during the latter part of February or the first of March. In both cases, these Gophers were observed near Rockford, Iowa.

Dr. C. Hart, Merriam, chief of the Division of Ornithology and Mammalogy of the U. S. Department of Agriculture, whose exhaustive and attractive works on the Pocket Gophers and other subjects in natural history entitles his statements to the highest consideration, says, regarding the general belief existing that the Pocket Gopher use their cheek pouches to "cart dirt" from their burrow's. "These cheek pouches are used exclusively in carrying food, and not in carting dirt as is often erroneously supposed." (See p. 17; North American Fauna; "Monographical Revision of the Pocket Gophers)."

Mr. Vernon Bailey, another eminent naturalist of the U. S. Department of Agriculture, says, regarding the same subject. "Although it is commonly supposed that the pouches are used for carrying dirt out of the holes, the fact is they are never used for this purpose. "In examining the pockets of more than a hundred specimens caught in traps I could find no evidence that they had been filled with earth. Occasionally specks of dirt from roots clung to the hairy inner surfaces, nothing more. If the pouches had been filled with earth, the short hairs would inevitably retain some of it. Furthermore, Gophers shot in the very act of pushing dirt from their holes had none in their

[3] The statements of this author are doubtless eminently correct, when applied to the species in the region he had under consideration (Elk River, Sherburne County, Minnesota); although apparently not applicable to the same species in the regions considered in this paper.

pouches." (See p. 15, Bulletin, No. 5, "The Pocket Gophers of the United States)."

The writer has, however, on several occasions in northern Iowa, observed this animal (*Geomys bursarius*), to carry dirt out of its burrow in its cheek pouches, and eject it in exactly the same manner as Dr. Merriam describes their method of emptying their cheek pouches of food, which is as follows: The fore feet are brought back simultaneously along the sides of the head until they had reached a point opposite the hinder end of the pouches; they are then pressed firmly against the head and carried forward. "In this ways the contents of the pouches are promptly dumped in front of the animal." (See p. 19, Monographical Revision of the Pocket Gophers.)

This action of the fore feet is also apparently accompanied by some muscular action of the cheek pouches themselves.

This act of carrying dirt in the cheek pouches, I have personally observed, and several times killed the animal while in the very act, and have with my own hands completed the operation. I am not, however, prepared to say that this is really a constant habit of this species in northern Iowa.

It seems scarcely possible that so high authorities and keen observers as Dr. Merriam and Mr. Bailey should be deceived in their observations of the habits of this species in this respect in the regions they have studied; so we may consider their statements when applied to those regions, as eminently correct.

PHOTOGRAPHING CEDAR BIRDS.

By Dr. R. W. Shufeldt.

It is now over five years ago since the writer in The American Naturalist invited the attention of photographers to the value to science of first-class photographs of living animals, taken in natural attitudes, so that they could be used as study-models for artists and taxidermists.[1] Since contributing that

[1] Shufeldt, R. W. Where young amateur photographers can be of assistance to Science. The American Naturalist, V. XXV, No. 295, Phila., July, 1891, pp. 626–630. Plate XIII, Figure 1.

article, and during the intervening period, not a little of my time has been spent in perfecting methods by means of which serviceable photographs could be made of the class of subjects just mentioned. Most of these experiments, however, were made last summer, and, upon the whole, with a degree of success far beyond my most sanguine hopes and expectations. From living specimens, and with the animals for the most part life size, in natural attitudes, and with natural surroundings, there have been obtained by me excellent photographic pictures of Opossums; White-footed Mouse (*Peromyscus leucopus*), in the act of jumping; Turkey Buzzard (life size head); nest and two young of *Icteria virens* (life size); also the same of Prairie Wabbler; Indigo Bird; Wood Thrush (*Turdus mustelinus*); Chipping Sparrow; Cat-birds; Red-eyed Vireo; several woodpeckers (mostly life size); various species of bats (life size); many snakes, lizards, hylas and toads; bumble-bee and flowers; and others too numerous to mention. Many of my photographs, too, not in this list, have been published, and appeared in various places.

My success with some of the birds was extremely gratifying, and I have succeeded not only in obtaining many beautiful pictures, but likewise a number that are in my opinion more truthful portraits of their subjects than any of the ordinary illustrations we usually see of them in zoological works and text-books.

Early last summer I had in my possession a pair of living Cedar Birds, and they were most gentle and remarkably tame. One of them is still mine, and is kept in a large cage in order that I may study the moult in that species, which process it is at this writing (October 11, 1896) passing through. During July, I also had a pair of nestling Cedar Birds, at the age they quit the nest. With these, as well as with the adults, I made many photographic studies. In my studio I obtained a fine, life size picture of the male, in a most animated attitude; the pair was also obtained, and were equally satisfactory. Out of doors the operation is far more difficult, and the effort to secure the young was rewarded with but partial success, while in taking the adults under nearly the same conditions, a much

better result was obtained. When I say nearly the same conditions, I mean that the young were attempted out in the open, were nothing obstructed the rays of the afternoon sun; while the old birds were tried in a piece of woods, where the light was nicely moderated by the shade of the trees. It is a reproduction (by the half-tone process) of this last picture that I desire to bring before the reader in connection with the present contribution. It was secured in the middle of the forenoon of a bright summer's day, under the following general conditions, to wit: by means of a large sheet of buff-colored blotting-paper the view was cut off beyond a small branch of poplar; this latter was next focused upon, and the camera made steady; next, the pair of birds were allowed to alight upon the limb at that part of it seen upon the camera's ground-glass. With closed shutter, and sensitive plate ready for an exposure, the proper moment must now be intently watched for, and with the pneumatic bulb in your hand, absolutely nothing must distract your attention, if you have any hope of obtaining a picture worthy of the name. Observe the light *most closely;* see to it that there is not a breath of air moving when you are ready to expose; make no sudden movements whatever, or your birds may, and likely will, quit the limb; let them become accustomed to their surroundings; and, finally, let your patience be absolutely inexhaustible. Thus it was I stood when I made the exposure—the male bird quietly assumed the attitude seen in the plate; while the female, with her back towards me, extended her neck to its fullest length (in that peculiar way these birds have), and slightly moved her right wing to avoid the annoyance of a couple of leaves that touched her shoulder. The diaphragm had but an eighth of an inch aperture, and the time was two seconds. One of the most difficult things to control in the out-of-door photography of small, wild animals is the light. It is not only the black, shiny bills of birds and backs of beetles that will take pure white, if they get the full benefit of the sun's rays during the exposure, but many other structures will produce the same undesirable result. Before I had much experience with this tricky factor I met with many disappointments, and ruined upon one

occasion nearly an entire box of the best plates in my endeavor to secure a picture of a pair of nestling Pewees (*Contopus virens*) in their nest. In the pictures the birds looked as though they had been *snowed on.* Cutting off the light from above in a later attempt rectified this defect. One good way to study the effect of the light, is upon the ground glass of the camera, when the subject has been carefully focused upon it—and I think it will be found a safe rule in many cases to make the exposure when a light cloud partially veils the sun's face. All such matters, however, can only be gained by experience; and to pass through this, the best of all schooling, one must be pre-armed with an enormous stock of the best kind of patience, with a slight reserve fund of the same article on hand in the event of a run upon the original supply.

The picture of the Cedar Birds taken in this way is reproduced in Plate I, January number of the NATURALIST.

THE BACTERIAL DISEASES OF PLANTS: A CRITICAL REVIEW OF THE PRESENT STATE OF OUR KNOWLEDGE.

BY ERWIN F. SMITH.

(*Continued from p. 41.*)

VI.

III. THE POTATO (SOLANUM TUBEROSUM L.)

1. THE GAS-FORMING WET-ROT OF THE TUBERS (1891).

(I) THE DISEASE:

(1) *Author, Title of Paper, Place of Publication, etc.*—This disease was studied by Dr. Ernst Kramer in 1890–91. His paper, entitled (40) *Bakteriologische Untersuchungen über die Nassfäule*

der Kartoffelknollen may be found in *Oesterreichisches landwirtschaftliches Centralblatt*, Jahrg. I, Heft 1, 1891, pp. 11–26, 2 text figures.

The rot of the potato has been known to the agriculturist for a long time and was described by Julius Kühn as early as 1830. Since that time it has been noticed or written upon extensively by many persons, *e. g.*, de Bary, Hallier, Reinke and Berthold, van Tieghem, Sorauer. For a time owing chiefly to the writings of de Bary, its ravages were confounded, especially in the popular mind, with those due to the potato mildew, *Phytophthora infestans*, but it has no necessary connection with this fungus although in Europe, at least, it usually follows the latter. Prior to Dr. Kramer's investigation the organism associated with the rot was usually considered to be *Bacillus amylobacter* van Tiegh. and this was supposed to be the same as the *Vibrion butyrique* of Pasteur, *Bacterium navicula* Reinke and Berthold, *Amylobacter clostridium* Trécul, *Bacillus butyricus* de Bary and *Clostridium butyricum* Prazm., but no one had approached the problem from a purely bacteriological standpoint using approved methods of isolation and inoculation.

The object of the author in undertaking this series of experiments was to determine first of all whether the wet rot was actually due to bacteria and, if so, how they gained entrance into the tuber; second, to identify the species and determine its morphological and biological peculiarities; third, to determine what decompositions it was capable of producing in the potato and in other substrata. Owing, says Dr. Kramer, to the fact that several bacteria cause the butyric fermentation and several color blue with iodine and agree in morphological particulars more or less closely with *Clostridium butyricum* Prazm. (*Bacillus butyricus* de Bary) "it appears still very questionable whether the specific cause of the wet rot is *C. butyricum* Prazm., especially as the predicated cause was not studied critically in relation to its morphology and biology by the above named investigators [Reinke and Berthold, van Tieghem, Sorauer]."

(2) *Geographical Distribution.*—Potato rot occurs in many parts of the world, in fact almost wherever the potato is cultiv-

ated, but by no means all of it is due to the particular organism isolated by Dr. Kramer, as the writer of this review has proved conclusively (see next review). Considering the readiness with which almost all bacteria grow upon cooked potatoes it seems not unlikely that even in its natural state the potato tuber may offer a suitable nidus for the growth of a variety of bacteria especially when it is kept unduly warm and moist. However, this may be, only two bacterial diseases of the potato have been worked out conclusively. The distribution of Dr. Kramer's wet rot of the potato is not known. Very likely it occurs in North America as well as in Europe but no one has established this fact, probably because no one has searched for the organism, his paper having been very generally overlooked. Even the European distribution of this rot is a matter of much doubt as it has probably been confused with the brown rot due to *Bacillus solanacearum.*

The potatoes from which were derived the bacteria used in these experiments came from the vicinity of Graz where the wet rot was very destructive in the autumn of 1890.

(3) *Symptoms.*—Under the influence of this disease the contents of the tuber becomes soft, pulpy, vile-smelling, and usually of a yellowish color. The disease may either attack the tubers before they are harvested or during the winter in the store houses. If one of these wet rotten tubers is pricked or squeezed a fluid pours out which has a strongly acid reaction and a very bad smell, mostly like butyric acid. Gas bubbles are also frequent. The remaining pulp, which is rather compact, gives an alkaline reaction either immediately or after a short time. This reaction is plainest in the tissues which have already become completely pulpy. At the commencement of the destruction of the potato while the tissue is still firm, the reaction is moderately acid.

The tubers forwarded to Dr. Kramer for investigation possessed all the above mentioned characteristics of wet rot. They still had a plump look. The skin was apparently uninjured but the whole potato was a bloated sack with a yellow ichorous contents. When punctured a very bad smelling, sour fluid escaped. The smell recalled butyric acid and amin bases

(trimethylamin). In some cases the escaping juice as well as the remaining pulp gave at first an acid reaction and subsequently an alkaline reaction.

(4) *Pathological Histology.*—Under the microscope the fluid pulp appeared to be composed of starch grains, single cells of the potato, or groups of such cells, fragments of cell walls, remnants of protoplasm, and countless numbers of bacteria, chiefly in the form of bacilli, These measured 1.5–5.0 x 0.8μ, and were actively motile. Frequently they appeared as though composed of non-septate threads, or were in chains. The single rods were rounded at the ends, while not rarely the longer threads appeared to be narrowed toward the extremity (zugespitzt). Ellipsoidal forms, 1 x 2μ, appeared regularly among these bacilli. A roundish, strongly refractive body was visible in the protoplasm of these ellipsoidal forms. This represented the beginning of spore formation, as was shown by later and more exact investigation.

(5) *Direct Infection Experiments.*—No direct infections.

(II) THE ORGANISM: Described as a bacillus but not named.

I have been in the habit of calling this organism Kramer's potato bacillus, and until such time as it can be re-studied and carefully compared with other gas and acid producing species it is probably best that it should remained unnamed. Some critical student of the species is certainly the only one who has any right to name it. We have had altogether too much of naming things without study, *i. e.* on the strength of the imperfect descriptions of other writers.

1. *Pathogenesis:*

(A) Yes.

(B) Yes. This was accomplished in the following manner. Wet rotten tubers having the skin still uninjured were cut open with sterilized knives and small quantities of the fluid pulp were transferred by means of a sterilized platinum loop into flasks closed by cotton plugs and half full of distilled, sterilized water, which was then well shaken to distribute the bacteria. To obtain a proper dilution definite quantities of this infected water were transferred to similar flasks, each

half full of sterilized water. From these second dilutions, the inoculations were made. The bacteria were isolated by the poured plate method, dextrose-peptone, nutrient gelatine being first used as a substratum, and subsequently nutrient glycerine agar which proved very satisfactory.

(C) Yes. The method of infection was as follows. The bacillus was first cultivated in a variety of fluid media until a suitable one was found. A watery potato juice with the addition of 1–2 per cent dextrose was finally selected as most suitable, the bacillus developing better in this than in any other medium. This broth was made as follows: Fresh potatoes were reduced to pulp and digested for some hours in cold water. The fluid was then filtered out and the dextrose added. The filtrate was then boiled, filtered again, and finally sterilized in the ordinary way under cotton plugs. A series of glass dishes (Präparatengläsern), about 8 cm. deep and 10 cm. broad, were filled half full of this broth. These dishes were closed by corks having a short, cotton-plugged glass tube passing through them. The vessels with the enclosed nutrient fluid were then sterilized by discontinuous heat. The potatoes to be tested were selected with great care, and their surface was sterilized as far as practicable in the following manner. These living tubers were first cleaned mechanically, then plunged for some minutes into a solution or mercuric chloride, and finally washed repeatedly in sterilized, distilled water. In this way some of the tubers (not all of them) were rendered completely sterile. The tubers were then placed in the sterilized broth in the glass dishes, the mass of the fluid having been so chosen that when the sterilized tubers were in place they were entirely covered by the broth. The fluid was then inoculated with small quantities of the bacilli, derived from pure cultures, by removing the cotton plug from the glass tube for a moment and inserting

the germs on the end of a sterilized platinum wire. The vessels were then placed in a brood oven at a temperature of 35°C. Within 12 hours the nutrient fluid became very turbid and began to give off gas bubbles rapidly.

After 8 days three vessels were opened and the potatoes taken out. Tubers and broth were examined immediately. In places the skin of the tubers exhibited folds and the tissue underneath appeared to be soft. When these spots were cut out and examined microscopically the entire tissue was found to be honeycombed, the intercellular substance being strongly swollen or entirely dissolved, the cell membranes wholly or partially destroyed, and the starch grains free in places.

After 14 days more vessels were opened and the potatoes removed. Under the skin of these tubers there were very soft spots and exact investigation showed that in these places the tissue was almost entirely destroyed so that great cavities were formed. The softened tissues surrounding these cavities gave a faint acid reaction and contained numerous bacteria.

Finally, after 20 days, the remainder of the potatoes were removed from the broth and examined. By this time the appearance of these tubers had entirely changed. They consisted only of bloated sacks filled with a half fluid pulp. Exactly as in case of the original wet rotten tubers the contents consisted of free starch grains, single cells and groups of cells, cell membranes, remnants of protoplasm, and myriads of bacteria. The fluid pulp gave a strongly acid reaction and had a smell like butyric acid. When such tubers were pressed, gas bubbles came out. Taken out of the nutrient fluid and kept in a damp chamber at 25°C., the tubers rapidly underwent a still further decay. After 12 hours the smell of butyric acid disappeared and the tissues showed a strong alkaline

reaction, accompanied by a smell recalling ammonia and amin bases.

Checks did not develop this rot. In sterile water they either remained sound for weeks or else, in case the skins were not thoroughly sterilized, contracted a different kind of decay, due chiefly to *Bacillus fluorescens.*

(D) Yes. In case of the tubers which were in the fluid 8 days the softened spots contained large numbers of bacteria (bacilli), which, when critically examined, turned out to possess all the morphological and biological characters of the bacteria obtained by pure cultures from the wet rotted potatoes, and from which the nutrient solutions had been inoculated. At the same time that the tubers were examined the solutions were subjected to an exact bacteriological investigation. In two instances no other bacteria were found in them than the sort which had been put in purposely. In the third case, several other bacteria were present, indicating that the skin of the tuber had not been completely sterilized.

In case of the tubers which remained in the fluid 14 days, the bacteria in the softened tissue around the cavities were isolated and found to be identical with those used for inoculating the fluid. In two cases also, only the inoculated form was obtained in cultures made from the nutrient fluid surrounding these tubers, and consequently there could be no doubt that the destruction of the tissues was due to these bacteria. Similar cultures were made from the tubers left in the broth 20 days, and with the same results. When cultivated out, the bacteria swarming in the rotten tubers proved to be morphologically and biologically identical with the form originally inoculated into the nutrient solution in which the tuber lay, and from which alone the infection could result. In brief, the previously sound potatoes became infected and wet rotten as a result of the action of the bacteria intro-

duced into the nutrient solution, and these bacteria had been previously cultivated pure from wet rotten potatoes.

Conclusion.—Pathogenic nature clearly established.

Remark.—"The objection may perhaps be raised that the artificially induced wet rot, just described, did not begin with infection from without, *i. e.* from the nutrient solution, but that bacteria were present in the apparently sound tissue of the potatoes used for the experiment, *i. e.* foci of infection dating from the harvest time, which later on with higher temperature and sufficient moisture, developed further. In opposition to this it may be stated, first, that the potatoes used in the experiment came from a locality in which, in previous years, wet rot had not appeared; and, second that the tissue of several of these potatoes was tested for the presence of bacteria, but always with negative results. The infection was also transmitted to sound tubers by puncturing them with a sterile platinum wire and then inserting into the stab a slight quantity of a bacterial, pure culture. These tubers were kept in a damp chamber at 35°C. The decay of the tuber, which always proceeded from the inoculation puncture, was identical with that of the wet rotten tubers. The wet rot of the potato tuber is, therefore, nothing but a decomposition of the same induced by a particular species of bacteria. Sorauer, and van Tieghem performed similar experiments but these differ from my own in that the investigators I have mentioned worked neither with bacterial pure cultures nor with sterilized tubers and sterilized nutrient fluids."

There is another objection which does not seem to have occurred to Dr. Kramer, viz., that the tubers which rotted were exposed to abnormal conditions. They were either submerged or placed in very moist air and quite likely deprived of their vitality through lack of aeration. They were also exposed to an unusually high temperature. Under these conditions, which would occur in the potato fields only exceptionally as the result of exceedingly hot weather and of very frequent or very prolonged rains, possibly many other organisms, which are usually saprophytic, might enter and destroy the tubers,

lying in the warm, wet earth. This seems to be established by Dr. Kramer's own experiments (see last paragraph under (II) 1 (C.). He has shown clearly that the species in question will produce wet rot, but not that many other species would not also produce it under like conditions. A much severer test of the parasitic nature of this organism would be the inoculation of the growing leaves and stems of the potato under normal conditions of temperature and moisture, simply by means of needle pricks. Under these conditions it is possible the organism might be shorn of much of its power or refuse to grow altogether. The determination of this point offers an interesting field of experiment for some one.

2. *Morphology:*

(1) *Shape, size, etc.*—This organism is described as a Bacillus. It forms rods 2.5–4.0 x 0.7–0.8 μ. On gelatine and agar plates chains are common, as are also apparently non-septate threads which frequently reach a length of 16 μ. and more. In nutrient fluids and on potato the rods are for the most part shorter, *i. e.* 1.5 to 2.0 μ. long. The rods are rounded at the ends. The threads taper off and are wavy. Spindle-shaped organisms could not be found.

(2) *Capsule.*—No mention of any capsule.

(3) *Flagella.*—The rods are actively motile. No mention of flagella.

(4) *Spores.*—Thicker, ellipsoidal forms occur in old cultures. These are 1.3 x 2.0 μ. They have a strongly developed membrane and their plasma becomes differentiated and more strongly refractive. This is the commencement of spore formation. The mature spores fill the whole interior of the cell.

(5) *Zoogloœa.*—No mention of zoogloœa.

(6) *Involution forms.*—No mention of any distorted forms.

3. *Biology:*

(1) *Stains.*—The vegetative rods take all the common anilin stains, and the spores may be colored very prettily by Neisser's method.

(2) *Gelatin.*—On plates of nutrient gelatin the organism forms dirty-white colonies, around the periphery of which the gelatin

liquefies allowing the colony to settle to the bottom of a pit. The funnel of liquefaction extends rapidly over large areas of the plate. Owing to this rapid liquefaction successful gelatin plates can be made only by very thin sowings. In most cases, the whole plate was soon liquefied at 25° C., if somewhat abundant sowings were made. In stab cultures, dot-formed colonies first develop along the track of the needle and finally fuse so that the stab appears as a thread. The liquefaction begins at the mouth of the canal and proceeds very energetically so that ordinarily in 48 hours at 25° C., the whole gelatin has become fluid. Streak cultures on nutrient gelatin are very characteristic. Within 12 hours the track of the needle appears as a raised dirty white line. The line spreads rapidly and widely to each side, forming a surface not unlike an elongated, irregularly margined leaf. Scarcely has this leaf formed when the gelatin begins to liquefy. Such streak cultures can be carried on only at room temperatures and with inoculations from cultures that have been grown on gelatin repeatedly; otherwise, the gelatin is liquefied too quickly.

(3) *Agar.*—On plate cultures of nutrient glycerin agar the organism forms small, dirty-white, slimy drops. When examined with a hand lens these appear to be round, have a sharp contour, and show in the interior a brownish center. In stab cultures the track of the needle appears as a thread, and the organism spreads from the mouth of the canal toward the periphery as a delicate layer (Auflagerung).

(4) *Potato, etc.*—On potato it forms a dirty-white, slimy layer, which at first gives an acid reaction, and then becomes strongly alkaline. The decomposition proceeds rapidly through the whole slice of potato, 2 to 3 days, at 25° C., being sufficient to involve the whole thickness. During this decay there is a copious evolution of gas from the interior, bubbles as big as a pin head bursting through the slimy covering and leaving in it little funnel shaped openings.

(5) *Animal Fluids.*—Judging from statements cited under *Pathogenesis* C., probably several were tried but there is no specific mention of anything but milk. In this fluid the organism caused the separation of the casein but no other

change. Unlike Hueppe's aerobic *Bacillus butyricus* it caused in the milk no formation of ammonia, leucin, tyrosin, and a bitter tasting substance, when kept at 25° C.,—not even after three weeks.

(6) *Vegetable Juices.*—This germ grew best of all in cooked potato juice to which 1–2 per cent of dextrose was added. At 35° C., this fluid became very cloudy in 12 hours and gas bubbles were given off.

(7) *Salt solutions and other Synthetic media.*—In dextrose solutions with addition of tartrate of ammonia or peptone and the necessary mineral substances (not stated what) the organism developed very satisfactorily with formation of carbonic acid and butyric acid. In a starch paste to which tartrate of ammonia and the common nutrient salts were added, the organism grew well but there was only a slight dissolving of the starch and no formation of butyric acid. For behavior in mineral solutions containing 5 per cent peptone see *Biology* 10 c.

(8) *Relation to Free oxygen.*—*Bacillus amylobacter* (*Clostridium butyricum* Prazm.), as is well known, grows only on exclusion of the air, and since the wet rot of the potato was generally attributed to this organism, Dr. Kramer first started anaerobiontic cultures. The inoculated nutrient dextrose-peptone gelatin was poured into plates and covered with films of mica. At the same time anaerobiontic cultures were started in Gruber's tubes, using dextrose-peptone, nutrient gelatin. The cultures were kept in a brood oven at 26° C. The colonies began to appear in 24 hours. On the plate cultures under the mica, after 48 hours, tiny colonies appeared which did not increase in size to any noteworthy extent. Colonies on the same gelatin, uncovered, developed rapidly, so that on the second day this was entirely liquefied. The liquefied gelatin smelled like butyric acid, *i. e.*, distinctly like sauer-kraut. In Gruber's tubes minute, dot-like colonies also appeared, but only a few of these developed any further. The larger colonies caused a circular liquefaction of the gelatin, 2–4 mm. broad and increasing but slightly. These experiments indicated that the organism is not anaerobic. A more careful examination of the

colonies in the Gruber's tubes showed that every colony buried in the gelatin was unable to develop further, and that only a few of the superficial ones reached a somewhat larger size and liquefied the gelatin. Evidently a slight quantity of oxygen remained in the tubes (it is impossible to pump out all the air) and this sufficed for the development of some of the colonies. The tiny, dot-shaped colonies under the mica, those in the Gruber's tubes, and those which produced liquefaction on the uncovered gelatin were then studied carefully and found to be all of one sort. They were bacilli agreeing exactly in their morphological characters with the rods which had been observed previously in the wet rotten tuber. That the dot-shaped colonies in the Gruber's tubes failed to develop further simply from lack of oxygen is best shown by the fact that after the opening of the tubes the growth of the colonies and the liquefaction of the gelatin proceeded so rapidly that within 12 hours the latter was completely liquefied, even at room temperatures.

(9) *Reducing and Oxidizing Power.*—In stab cultures in nutrient gelatin rendered blue by tincture of litmus, a confluent, dirty-white growth was formed in the canal, and at the same time the gelatin began to change from blue to red, commencing at the upper end of the stab. When this reddening had reaching the bottom of the tube the gelatin began to liquefy commencing at the upper end of the stab. Along with this liquefaction there was a complete bleaching of the litmus, the gelatin resuming its original yellow color. It could not be determined whether this reduction should be referred to removal of oxygen or to the liberation of hydrogen. Nutrient gelatin stained red by carminic acid was also entirely bleached by this bacillus.

(10) *Fermentation Products and other Results of Growth:*

(a) *Gas Production.*—The organism causes a copious evolution of gas from potato tubers, living or steamed; potato broth with dextrose; and dextrose solutions containing ammonium tartrate and mineral salts. This gas was determined to be CO_2. No mention is made of any hydrogen. Possibly some was overlooked.

(b) *Formation of Acids.*—The bacillus produces a strong acid reaction in solutions or substrata containing sugar, *i. e.*, in the potato; in steamed potato juice with addition of 1–2 per cent dextrose; and in dextrose solutiónes containing tartrate of ammonia and the necessary mineral substances; but not in starch paste with ammonium tartrate and the nutrient mineral substances, nor in peptone solutions containing nutrient mineral substances. This acid was determined to be butyric and in the following manner. The soft contents of a tuber in the first stage of rot while still acid, was extracted in water by boiling, filtered, and mixed with a small quantity of calcium carbonate. A white precipitate resulted, presumably of calcium butyrate. This was, consequently, filtered boiling hot. The precipitate which crystalized out of the liquid exhibited under the microscope the very characteristic rhombic prisms of calcium butyrate. When this salt was mixed with dilute hydrochloric acid a fluid resulted which was miscible in water, had a boiling point of 163° C., and possessed the characteristic smell of butyric acid.

(c) *Production of Alkali.*—In the second stage of the rot the tissues show a strong alkaline reaction. If a little of the soft contents of a tuber in this stage of the rot is mixed with a few drops of distilled water, the fluid filtered, and the filtrate mixed with Nessler's reagent, a decided brown color appears instantly, indicating ammonia. A part of this ammonia combines with the free butyric acid to form ammonium butyrate and the remainder serves to render the decomposed tissues strongly alkaline. The ammonia is attributed to the decomposition of albuminoid substances by the bacillus. As additional evidence, it is stated that if a 5 per cent peptone solution containing the necessary nutrient mineral substances be inoculated with a pure culture of this bacillus, a sort of rotting fermentation takes place, the first evidence of which is a strong ammoniacal smell. Nessler's solution indicates the presence of ammonia.

(d) *Formation of Pigment.*—Growth described as dirty-white on agar, gelatin, and cooked potato.

(e) *Development of Odors.*—As already stated, there is a strong odor of butyric acid in the first stage of the rot, and subsequently other bad odors appear. The latter are due to ammonia, methylamin, and especially trimethylamin. The existence of the amin bases was determined as follows. Methylamin was found by taking a little of the thoroughly rotted tissue, mixing it with water, filtering, and mixing the filtrate with platinous chloride, whereupon there resulted a green precipitate, $PtCl_2$ $2CH_3$ NH_2. Trimethylamin was detected by adding to a second part of the filtrate acid (salzsaures) platinic chloride, the resulting orange precipitate consisting only of the well developed octahedrons of the corresponding platinic double salt. The formation of these amin bases is attributed to the action of the bacillus on the nitrogenous part of the substratum. They were also detected by the same methods in the above mentioned mineral solution containing 5 per cent peptone, and consequently must have been derived from the peptone. These substances may also be detected in old pure cultures of this bacillus in peptone nutrient gelatin.

(f) *Enzymes.*—No mention is made of any study of these bodies. The organism undoubtedly produces several since it is capable not only of peptonizing gelatin and of dissolving cellulose but also of attacking albuminoids. Starch is but little affected.

(g) *Other Products.*—See *Biology* 10e.

(11) *Effect of Dessication.*—No statement. Probably not readily injured by dry air. Forms spores.

(12) *Thermal Relations:*

(a) *Maximum for Growth.*—Not determined.

(b) *Optimum for Growth.*—Not determined. This germ grows well at 25° C., and at 35° C., apparently most rapidly at the latter temperature.

(c) *Minimum for Growth.*—Not determined.

(d) *Death Point.*—Not determined.

(13) *Relation to Light.*—No statement.

(14) *Vitality on Various Media.*—No statement. The organism forms spores.

(15) *Effect on Growth of Reaction of Medium (acid, neutral, alkaline).*—No specific statement. Organism will evidently grow in either acid or alkaline media.

(16) *Sensitiveness to Antiseptics and Germicides.*—No statement.

(17) *Other Host Plants.*—No mention of any.

(18) *Effect upon Animals.*—No mention of any tests.

(III) Economic Aspects:

(1) *Losses.*—Serious.

(2) *Natural Methods of Infection.*—The question at once arises: How is the disease spread in the field, the tuber being, as is well known, carefully protected from external injuries by a firm layer of cork cells. If this layer is not punctured or broken the tuber appears to be safe from parasitic attacks. Even when the bacillus was placed on the cut surface of a living tuber in the air of an ordinary room, Dr. Kramer found that it was never able to cause the disease, the tuber developing a protective layer of cork cells under the mass of bacilli before they could grow. The case was quite different, however, when tubers lying in the infected nutrient solutions were stabbed with a sterile platinum wire. When, after 8 days, such tubers were examined by cutting through the stab, the canal in most cases was found occupied by the bacteria, and the decay of the tissue was seen to have proceeded from this canal outward. If the cork covering was shaved off in any place, the infection ordinarily began there. There is, consequently, no doubt that in the presence of sufficient moisture the bacteria can gain an easy entrance if the corky covering of the tubers is injured in any way, and such injury, we know, is frequently brought about by insects. It is well known also that the lenticels open when potato tubers are exposed to moisture for some time, *e. g.*, in wet earth, and this readily accounts for the infection of uninjured tubers. Indeed, Dr. Kramer demonstrated experimentally that in apparently uninjured tubers lying in his infected broths the rot frequently began with a darkening and softening around the lenticels, these changes being visible within a few days. When such spots were examinsd it was found that the bacteria had already penetrated into the tissue

in considerable numbers. Dr. Sorauer attributed the infection of sound tubers to this cause and Dr. Kramer was thus able to confirm it.

(3) *Conditions Favoring the Spread of the Disease.*—There is nothing on this subject beyond the statement that potatoes rich in sugar would be attacked and destroyed sooner than those rich in starch. It is clear, however, that this disease is likely to be most prevalent in warm and wet autumns, high temperatures and excessive rainfall offering favorable conditions for its development.

(4) *Methods of Prevention.*—No experiments, and no observations. Disease not studied in the field. Of course, whenever warm, rainy weather occurs in autumn potato rot of some sort is likely to appear, and common sense would dictate the prompt digging of the tubers and their storage in thin layers in a dry place, otherwise the whole crop may be destroyed in the ground, or subsequently in the pit or cellar.

Remark.—In the later stages of decay *Bacillus fluorescens* is quite common, and one is also likely to find almost any of the common soil bacteria. This paper was announced only as a preliminary communication, but no second paper has been published, so far as known to the writer.

This organism differs from *Bacillus amylobacter* van Tiegh. (*Clostridium butyricum* Prazm.) in that the latter is strictly anaerobic, produces spores in spindle shaped cells and colors blue with iodine. *Bacillus butyricus* Botkin, which is thought by Lehmann and Neumann (**41**) *Bakteriologische Diagnostik*, Munich, 1896, Bd., II, p. 315, to be distinct from the preceeding, is also strictly anaerobic. *Bacillus butyricus* Hueppe differs from Dr. Kramer's organism in the way metioned above (II) 3 (5) in the absence of gas production, and in some less important particulars. A number of other butyric acid forming species have been described but all more or less imperfectly.

EDITOR'S TABLE.

WHILE the primary object of the University is instruction, there are several reasons why original research is of more than incidental importance to its prosperity. The mastery of his subject, which is characteristic of the man who advances the knowledge of it, is an essential of a good teacher. The belief in this truth is so general that the teacher who is known as a discoverer will more successfully attract students to his classes than he who is not so known. But, apart from this, the general reputation of a school before the public is more surely affected by the research work that issues from its faculty, than the managing bodies of some of them seem willing to admit. As an advertisement, successful original work is incomparable. It serves this purpose in quarters where the detailed work of the university is of necessity unknown. We know how it is with our estimate of institutions of foreign lands; we know them by the work of their professors in original research. We believe that those universities which permit of the production of original work by those of its professors who have proven themselves competent for it, are wise above those who do not do so. Those who load such men with teaching, so as to forbid such work, reduce their prosperity. We regret to learn that a tendency to the latter course is increasingly evident in some of our great schools. Who, in the chemical world, does not think the more highly of Harvard, on account of the work of a Gibbs; how much better is Brown known through the work of a Packard, and so on? Chicago, Pennsylvania and Cornell profit greatly in various fields by the work turned out by certain members of their faculties. Who does not know Columbia, Princeton and Johns Hopkins as the seat of the labors of men whose names are familiar to every American? Yet, in a few of these institutions, the prosperity brought by these very men is becoming the means of choking their vitality of these their life centers, by the increase of drudgery which it brings. The managers will be wise to preserve for these men sufficient leisure to enable them to advance the frontiers of the known, and thus to obtain juster views of things as they are, and to bring us ever nearer to a comprehension of the great laws, whose expressions it is their business to teach to the growing intelligences of the nation. By all means nourish the nuclei of the mental life, which will thus preserve the vitality of the cytoplasm of society, and protect them from being smothered by it into stagnation and ultimate crystallization.

PROFESSOR WOODROW WILSON delivered an address at the recent susquicentennial anniversary of Princeton University, which contained pointed reference to the energy displayed by the sciences in the field of thought and education at the present time. This reference not only pointed out what the sciences are not competent to do, but was distinctly uncomplimentary in its allusion to supposed evil-effects on the minds of its cultivators, which he characterized as "noxious gases which issue from the laboratory." Whatever Prof. Wilson's private views may be, his expressions in this address did not include those qualifying words which are in place in dealing with the subject from the point of view which is to our mind the broadest and best. If the sciences do not teach the humanities from the side of the ideal and the esthetic, they enforce them in sterner fashion by an exposition of the nature of necessity. We may also admit, that the humanities are not their field in general; but they are none the less beneficial to thought as well as to practical life on that account. The scientific training appears to us to be of inestimable value, as supplying the habit of orderly thought, which must infallibly lead to the truth in whatever field it may be applied. Let the humanities flourish, but let then not decline the aid of the sciences. Together they constitute a working partnership, which embraces the field of human culture, and gives the mind all sides of reality, which includes not only "sweetness" but "light".

RECENT LITERATURE.

Bailey's Survival of the Unlike.[1]—This new book from the facile pen of Professor Bailey consists of essays and papers all of which have been presented elsewhere, and now brought together in accordance with the author's plans. Thus while a collection of essays, it is not without unity. "In making these essays" the author says, "I have constantly had in mind their collection and publication and have, therefore, endeavored to discuss the leading problems associated with the variation and evolution of cultivated plants, in order that the final collection should be somewhat consecutive."

The following quotations from his very suggestful preface will give the reader a general idea of the author's position. "The underlying

[1] *The Survival of the Unlike*, a collection of evolution essays suggested by the study of domestic plants, by L. H. Bailey. New York, The Macmillan Company, 1896, 515 pp., 8vo.

motive of the collection is the emphasis which is placed upon unlikenesses and their survival because they are unlike. The author also denies the common assumption that organic matter was originally endowed with the power of reproducing all its corporeal attributes, or that, in the constitution of things, like produces like. He conceives that heredity is an acquired force, and that, normally or originally, unlike produces unlike." The author's *a priori* reasons for belief in the hypothesis of evolution are "the two facts that there must be a struggle for existence from the mere mathematics of propagation, and that there have been mighty changes in the physical character of the earth, which argue that organisms must either have changed or perished." On the other hand, "the chief demonstrative reason for belief in evolution is the fact that plants and animals can be and are modified profoundly by the care of man."

The body of the book is in three "parts," the first including essays touching the general fact and philosophy of evolution; the second, those expounding the fact and causes of variation; and third, those tracing the evolution of particular types of plants. The first essay gives name to the book. In it the author discusses (1) the nature of the divergences of plants and animals, suggesting the Mycetozoa as the point of divergence; (2) the origin of differences, holding that all plants and animals came from one original life-plasma which had the power of perpetuating its physiological but not its structural identity, no two organisms ever being exactly alike, it follows that unlike produces unlike; (3) the survival of the unlike, this being an extension of our notion of the meaning of the phrase "the survival of the fittest," by showing that the fittest are unlike.

The author gives us some interesting pages on the species dogma, in which he pointedly shows the inconsistency of those who demand experimental evidence of the evolution of a species, and yet reject "horticultural species" because they have been produced under cultivation. Many examples are given of the origination of well marked "varieties" which are much more different from the species from which they sprung than are the recognized species from one another. Here Professor Bailey's experience as a horticulturist enables him to cite striking examples of what the candid reader must admit are good species of beans (Phaseolus), tomato (Lycopersicum), maize (Zea), soy beans (Glycine), etc. The horticulturist who is familiar with the plasticity of plants, and who is accustomed to see new and persistent forms arise, cannot help being an evolutionist, nor can he help being impatient with the botanist who refuses to accept such forms as true varieties or species as

much entitled to recognition as those whose origin we do not happen to know.—CHARLES E. BESSEY.

Prillieux's Diseases of Plants.[2]—Among recent contributions to botanical literature is the first volume of a work on the diseases of agricultural plants including forest and fruit trees by Ed. Prillieux, Professor in the ("Institut National Agronomique," Paris). The work is the outcome of the author's twenty years study and teaching of Economic Vegetable Pathology.

In the introduction the change in the methods of viewing plant diseases is referred to. Instead of trying to trace an anology between human pathology and phytopathology, plant diseases came to be regarded as due to changes of normal physiological functions produced either by unfavorable conditions or by the action of parasitic organisms penetrating the tissues. The placing of phytopathology on a more rational basis is attributed to De Candolle.[3] In this connection Unger[4] might well have been cited.

The author next speaks of the aims and purposes of the work. He says: "If I am able to render the study interesting and intelligible to agriculturists and to all persons living in the country who have received some general knowledge of the structure of plants, I shall have obtained the end I have in view."

In speaking of the difficulties of studying minute parasitic plants he adds: "It seems to be established that such researches present too many difficulties to be carried on by any one who wishes. My greatest desire is to dissipate this belief and to facilitate the beginnings of observers who, living in the country, are able to test on cultivated plants the facts already observed and described, and to examine the parasites in quantity in all their stages of development. If they acquire a taste for these researches they may be able in their turn to add many new facts to science." We believe the many acute investigators who after thorough equipment have spent years in trying to solve some of the problems presented by plant diseases will not think us pessimistic if we venture to predict that the author's hopes regarding the contributions to the life histories of parasitic fungi which he expects from the novice will not be realized. If, however, he succeeds in getting the intelligent farmers to observe carefully the parasitic plants

[2] Prillieux, Ed. *Maladies des Plantes Agricoles et des Arbres fruitiers et Forestiers causées par des parasites végétaux.* Home Premier, Paris, 1895.

[3] De Candolle, Aug.-Pyr. *Physiologie Végétale.* Paris, 1832.

[4] Unger, Franz. *Die Exantheme der Pflanzen.* Wien, 1833.

which destroy their crops, and to study and become familiar with the facts that have already been established by investigators he will have rendered an incalculable service. He next refers to the diverse forms and various stages in the life histories of many disease-producing parasites and the necessity of knowing all the facts connected with the conditions of their propagation and growth, and the importance of this knowledge as a basis in devising means of preventing or combatting them. It seems to us he might well have urged in addition the need of a comprehensive knowledge of the complex physiological activities of plants under normal conditions, as this must be the basis for an understanding of abnormal or pathological conditions, and must precede any rational treatment of such conditions.

The remainder of the introduction is devoted to detailed directions for the use of the microscope. These directions are intended for beginners, and cover the simple manipulations of the instrument as used in the elementary study of plant histology.

The various parasites of which the volume treats are arranged in systematic order. The first part treats of "Cryptogamic Parasites other than Fungi." These are discussed in two chapters, one on Bacteria and one on Myxomycetes. The second part treats of "Parasitic Fungi," to which five chapters are devoted in the following order: Phycomycetes, Ustilagineæ, Uradineæ, Basidiomycetes and Ascomycetes. The style is rather concise and exact, though not so technical as to make the work forbidding or unintelligible to the non-scientific reader. The numerous figures, though in many cases crude, give a fair idea of the general characters of the object represented. It would seem that in a work intended for the use of agriculturists and horticulturists more attention might profitably have been given to the treatment of the diseases discussed. There can be no doubt, however, of the usefulness of the work, and if the class for whom it is especially intended can be prevailed upon to use it, it will assist greatly in popularizing and advancing a branch of botany which is at present in its infancy, but which is destined to great growth in the near future.

C. L. Shear.

Campbell's Mosses and Ferns.[5]—This book has appeared at a most opportune time in the history of botanical science, if, indeed, a long-wished for book can ever fail to be opportune. The Archegonia-

[5] *The Structure and Development of the Mosses and Ferns* (Archegoniatæ), by Douglas Houghton Campbell, Ph, D., Professor of Botany in the Leland Stanford Junior University. Macmillan and Company, London and New York, 544 pp., 8vo

tæ have long been most fruitful objects of research, and the bearing of the results of such investigations upon the terminations and the beginnings of phylogenetic lines has been of absorbing interest. It was to be expected that such a field would attract the attention of many of the best botanists. So true is this, that the literature of botany for the past fifteen years has abounded in articles upon the morphology and the embryology of the Archegoniatæ. The activity of specialists along these lines has been so great that the general student has long since been compelled to relinquish the task of keeping himself accurately informed of the most recent investigations and theories. The publication of these results in numerous diverse periodicals rendered all the more imperative the demand for their collation and co-ordination. Above all, it was desirable that these collected data should come to us, not as the compilation of some superficial student of the subject, perhaps, but as a judicious and discriminating compendium based upon no inconsiderable amount of original work.

To the making of a book for American students, no one, probably, could have brought out a longer experience or a greater knowledge of the subject than the author of the present volume. The collection and arrangement of the scattered data of numerous texts and their presentation, together with the extensive results of original research, has been done in a masterful manner. The information gained by the author's own investigations have enabled him to construct an admirable ground plan into which he has woven the results of others in a most skillfully relevant fashion. Though dealing with a subject not a little complicated, the general scheme of the text is particularly fortunate, and the subject matter itself much more than ordinarily perspicuous.

A critical compilation entails the discussion of numerous antagonistic views and theories, and renders necessary a discriminating treatment of them. The author has here had no easy task and merits especial congratulation upon the successful manner in which he has acquitted himself. It would have been no more than expected if he had permitted himself to incline rather strongly toward his own views upon mooted questions. Yet such is not the case. In all instances, the arguments on both sides have been presented in the fullest manner and, in some cases, in a spirit of fairness, he has conceded, perhaps, more than necessary. The bringing together of such a mass of facts and theories has given the author a rare opportunity to deduce the tendencies which they suggest, and to critically weigh the contradictory opinions to which they have given rise. This has been thoroughly done, and the book, besides standing as a most able symposium of the pres-

ent knowledge concerning the Archegoniatæ, will be of almost inestimable value for its effectual relegation of worn out ideas, and its lucid elaboration of those which are to direct future thought in these lines.

The text treats consecutively of the various orders and families of Bryophyta and Pteridophyta, dealing exhaustively with their organogeny and morphology, and discussing ir a concise manner their classification and general affinities. The peculiar thoroughness and completion of the work are among its most pleasing features. From its comprehensiveness, it must be primarily a reference book, and the subject matter has been so subdivided and arranged as to greatly facilitate this purpose.

The typography of the book is good, perhaps rather above than below that which should be regarded as standard for any scientific work, in order that it may not receive unfavorable mention. Many of the figures unfortunately, show the effects of haste, whether upon the part of the artist or of draughtsman is not certain. It is to be regretted that the illustrations, which so often make a poor book, has here been permitted to mar so good a one.

I shall not place an incubus upon the book by calling it "epoch-making;" such can never be truthfully said of any scientific work. It does stand, however, as a most welcome and effective milestone, not merely for the general student of botany, but for the specialist as well. Not only will it remain for a long time a much thumbed summary, but it must be regarded as indicating at least the most immediate lines of future research among the Archegoniatæ.

FREDERIC E. CLEMENTS.

AMERICAN NATURALIST LIST OF RECENT BOOKS AND PAMPHLETS.

ANDREWS, C. W.—Note on the Pelvis of *Cryptoclidus oxoniensis* (Phillips). Extr. Geol. Mag., Decade IV, Vol. III, 1896.

——Note on the Skeleton of *Aptornis defossor*. Extr. Geol. Mag. London, 1896.

——On the Structure of the Plesiosaurian Skull. Extr. Quart. Journ. Geol. Soc., May, 1896.

——On the Skull, Sternum and Shoulder Girdle of Æpyornis. Extr. The Ibis, July, 1896. From the author.

BAIN, H. F.—Geology of Woodbury Co. Extr. Iowa Geol. Surv., Vol. V, Ann. Rept., 1895. Des Moines, 1896. From the Survey.

BANGS, O.—Notes on the Synonymy of the North American Mink with Description of a New Subspecies.

BECKER, G. F.—Reconnaissance of the Gold Fields of the Southern Appalachians. Extr. Sixteenth Annual Rept. U. S. Geol. Survey, 1894–95, Part II. Washington, 1895. From the author.

Contributions from the Geological Department of Columbian University, No. XXXIII. From the Univ.

COOKE, M. C.—Across the Common. London, 1895. From T. Nelson and Sons, Publishers.

COQUILLETT, D. W.—Revision of the North American Empidæ—a Family of Two-winged Insects. Extr. Proceeds. U. S. Nat. Mus., Vol. XVIII. Washington, 1896. From the Museum.

CROSBY, W. O.—Tables for the Determination of Common Minerals. Boston, 1895. From the author.

CURTIS, M. M.—An Outline of Philosophy in America. Reprint from the Western Reserve Univ. Bull., March, 1896. From the author.

DEAN, B.—Is Palæospondylus a Cyclostome? Extr. Trans. N. Y. Acad. Sci., Vol. XV, pp. 101–104.

——Sharks as Ancestral Fishes. Extr. Natural Science, Vol. VIII, 1896. From the author.

DEPERET, C.—Sur quelques mammifères de l'étage Burdigalien (premier étage Mediterranéan) (de Suisse et du bassin du Rhone). Extr. Compte Rendu Soc. Geol. de France Nr. 13, 1896.

——Note sur les Dinosauriens, Sauropodes and Théropodes du Crétacé supérieur de Madagascar. Extr. Bull. Soc Geol. de France (3), XXIV, 1896. From the author.

ELDRIDGE, G. H.—A Geological Reconnaissance in Northwest Wyoming. Bull. No. 119, U. S. Geol. Surv. Washington, 1894. From the U. S. Geol. Surv.

FAIRCHILD, H. L.—Kame Areas in Western New York south of Irondequoit and Sodus Bays. Extr. Journ. Geol., Vol., IV. Chicago, 1896.

——Glacial Genesee Lakes. Extr. Bull. Geol. Soc. Amer., 1896.

——Physical Characters of Monroe Co. and Adjacent Territory. Extr. Proceeds. Rochester Acad. Science, Vol. 3. Rochester, 1896. From the author.

GANNETT, H.—A Geographic Dictionary of New Jersey. Bull. No. 118, U. S. Geol. Surv. Washington, 1894.

——Results of Primary Triangulation. Bull. No. 122, U. S. Geol. Surv. Washington, 1894. From the U. S. Geol. Surv.

Geologische Karte von Böhmen Section II and III. Archiv. der Naturwiss. Landesdurchforchung, X Bd., Nro. 1. Prag, 1895.

GILL, T.—The Differential Characters of the Syngnathid and Hippocampid Fishes. Extr. Proceeds. U. S. Nat. Mus, Vol. XVIII, 1895. From the Museum.

GOODE, G. B.—The Principles of Museum Administration. Extr. Ann. Rept. Mus. Assoc., 1895. York, 1895. From the author.

GROOS, K.—Die Spiele der Thiere. Jena, 1896. From the author.

GRULICH, O.—Geschichte der Bibliothek und Naturaliensammlung der kaiserlichen Leop. Carol. deutschen Akad. d. Naturf. Halle, 1894.

HATCHER, J. B.—Recent and Fossil Tapirs. Amer. Jour. Sci, Vol. I, 1896. From the author.

HERRICK, F. H.—The American Lobster: A Study of its Habits and Development. Extr. Bull. U. S. Fish Commission for 1895. Washington, 1895. From the author.

HOLLAND, W. J.—Lists of Lepidoptera collected in East Africa by (1) Dr. W. L. Abbott; (2) W. A. Chanler and Lieut. von Hoehnel; (3) from East African Islands, collected by Dr. W. L. Abbott; (4) from Kashmir, collected by Dr. W. L. Abbott. Extr. Proceeds. U. S. Natl. Mus., Vol. XVIII. Washington, 1895. From the Smithsonian Institution.

International Zoologist's Directory. Berlin, 1895. From Friedländer & Sohn, Pub.

KEYES, C. A.—Bibliography of North American Paleontology, 1888–1892. Bull. No. 121, U. S. Geol. Surv. Washington, 1894. From the U. S. Geol. Surv.

KLVANA, J.—Das Moldauthal zwischen Prag und Kralup. Aus Archiv. der Naturwiss. Landesdurchforschung, IX, Bd., Nro. 3. Prag, 1895. From the author.

LUTCHER, H. J.—A Stronger and More Permanent Union. Orange, Texas, 1896. From the author.

MEARNS, E. A.—Preliminary Diagnoses of New Mammals from the Mexican Border of the United States. Extr. Proceeds. U. S. Natl. Mus., Vol. XVIII. Washington, 1896. From the Smithsonian Institution.

MERCERAT, A.—Etude comparée sur des Molaires de Toxodon et d'autres Représentants de la même famille. Extr. Annales del Museo Nacional de Buenos Aires, T. IV, 1895. From the Mus.

MOENKHAUS, W. J.—Notes on a Collection of Fishes of Dubois Co., Indiana. No reference given.

——Variation of North American Fishes, II. The Variation of *Etheostoma caprodes* in Turkey Lake and Tippecanoe Lake. Extr. Proceeds. Ind. Acad. Sci., No. 5, 1895. From the author.

Proceedings of the Biological Society of Washington, Vol. IX, 1894–95. From the Society.

PROSSER, C. S.—The Devonian System of Eastern Pennsylvania and New York. Bull. No. 120, U. S. Geol. Surv. Washington, 1894. From the U. S. Geol. Survey.

PUMPELLY, R., J. E. WOLFF AND T. N. DALE.—Geology of the Green Mountains.——Monographs of the United States, Vol. XXIII. From the U. S. Geol. Survey.

REIS, O.—Zur Osteologie und Systematik der Belonorhynchiden und Tetragonolepiden. No date given. From the author.

SIMPSON, C. T.—The Classification and Geographical Distribution of the Pearly Freshwater Mussel. Extr. Proceeds. U. S. Natl. Mus., Vol. XVIII, 1896. From the Museum.

SMITH, H. M.—History and Results of the Attempts to Acclimatize Fish and other Water Animals in the Pacific States. Art. 10, Bull. U. S. Fish Commission for 1895. Washington, 1896. From the Commission.

SMYTH, C. H.—Metamorphism of a Gabbro occurring in St. Lawrence Co., N. Y. Extr. Amer. Journ. Sci., Vol. I, 1896. From the author.

Transactions of the Wisconsin Academy of Arts, Sciences and Letters, Vol. X. Madison, 1895. From the Academy.

VAN BIERVLIET, J. J.—Eléments de Psychologie Humaine. Paris, 1895. From the author.

WALCOTT, C. D.—Fossil Jelly-Fishes from the Middle Cambrian Terrane. Extr. Proceeds. U. S. Natl. Mus., Vol. XVIII. Washington, 1896. From the Museum.

WEEKS, F. B.—Bibliography and Index of North American Geology, Paleontology, Petrology and Mineralogy for 1894. Bull. U. S. Geol. Surv. No. 135. Washington, 1896. From the Survey.

WHITE, C. A.—The Bear River Formation and its Characteristic Fauna. Bull. U. S. Geol. Surv. No. 128. Washington, 1895. From the Survey.

WOODWARD, H.—Address delivered at the Anniversary Meeting of the Geological Society of London, Feb. 15, 1895.

General Notes.

PETROGRAPHY.[1]

Petrography of the Viterbo Region, Italy.—Washington[2] continues his description of the young volcanic rocks of Italy in an article dealing with the lavas of the interesting Monti Cimini, Monte Venere and Monti Vico. The principal rocks of the district are vulsinite, composed of phenocrysts of orthoclase, plagioclase, diopside and biotite in a trachytic groundmass consisting of diopside, magnetite and the feldspars; ciminite composed of small olivine, diopside, plagioclase, and sanidine phenocrysts in an andesitic felt of diopside needles, magnetite grains and feldspar laths—both orthoclase and plagioclase; peperino—a trachy andestic tuff, and a series of leucite rocks belonging with the leucite phonolites. The phonolites from Monte Venere are characterized by the presence of phenocrysts of biotite. Analyses of the three principal types are given as follows:

	SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	H_2O	TiO_2	
Vulsinite	57.32	19.85	2.21	2.35	1.60	3.82	3.22	9.15	.57		=100.09
Ciminite	55.44	18.60	2.09	4.48	4.75	6.76	1.79	6.63	.25	.16	=100.75
Leucite phonolite	55.21	19.81	2.69	2.86	1.68	4.61	3.13	8.45	.99.	tr	= 99.43

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Journal of Geology, IV, p. 826.

Missourite, a New Leucite Rock.—The body of rock constituting the core of one of the volcanic centres of the Highwood Mountains, Montana, is a new type of leucite rock named Missourite by Weed and Pirsson.[3] The rock is in the form of a stock intrusive in Cretaceous shale. It varies in character in different places, but is of the same general nature in all. The coarsest grained variety is a dark gray granular rock composed of grains of fresh olivine, of pale green augite, of brownish-yellow biotite, apatite and iron oxides embedded in perfectly clear leucite in formless masses. The composition of the mineral is as follows:

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	Na_2O	H_2O	Total
54.46	22.24	.68	tr	.10	18.86	.70	2.29 =	99.33

A slight zeolitization has occurred in some of the leucite, the new products being analcite and a new potash zeolite analogous to natrolite. An analysis of the rock yielded:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	H_2O	TiO_2	P_2O_5	BaO	SrO	SO_3	Cl	Total
46.06	10.01	3.17	5.61	14.74	10.55	1.31	5.14	1.44	.73	.21	.32	.20	.05	.03 =	99.57

This is very close to the composition of absarokite.[4] Since the structure of the missourite is granitic, the author classifies it as the plutonic equivalent of the leucite basalts.

The Crystalline Schists of the Spessart.—According to Klemm[5] the crystalline rocks of the Spessart, Germany, comprise granites and schists of unknown age, with which are associated basic intrusive and effusive rocks and their tuffs. The schists occur on the periphery of a great granite mass, dykes from which have intruded them. Among the foliated rocks are quartz-schists, mica-schists, staurolite-schists, calc-silicate hornfels, limestone, amphibolites and metamorphosed sandstones and graywackes. The biotite, staurolite and other similar constituents exhibit no evidences of the action of pressure upon them, although the rocks in which they occur are highly schistose. This fact leads the author to conclude that the foliation of the rocks was imposed upon them when in a plastic state and not after they had become rigid. The amphibolites are thought to be metamorphosed tuffs. The granite is a biotitic variety with a foliation produced by pressure, but in this case as in the case of the schists, the foliation was produced before the rock finally solidified. In the character of its intrusion the granite is lacco-

[3] Amer. Jour. Sci., Vol. II, 1896, p. 315.
[4] Cf. AMERICAN NATURALIST, p. 299.
[5] Zeits. deutsch. geol. Geo., XLVII, p. 581.

litic. After discussing the nature of the schists and gneisses of this region the author concludes his paper with the statement that the term gneiss should be used in a geological sense only when the origin of the rock designated by it is unknown. He further surmises that many gneiss areas will, upon close study, be found to be underlain by granites and various schists whose nature can be learned.

Instruments.—Leiss[6] describes a number of new instruments for the use of petrographers. They are made under the direction of Fuess of Berlin. The first instrument is a microscope with nicols so arranged as to be capable of revolution independent of the stage. The stand is constructed for the attachment of the ordinary accessories. The three models at present on the market are known as VII, VIIa, VIII. The second instrument is a simplified form of Federow's universal stage, admitting of the revolution of an object about two axes while under the microscopic objective. The third is the apparatus planned by Klein to aid in the examination of thin sections immersed in liquids. The other instruments described are a compensator-ocular, invented by J. Amann, a mica-wedge after the pattern proposed by Federow, a vertical illuminator for use with opaque objects, a very simple microscope camera made to fit over the ocular of an ordinary microscope and an achromatic condenser for use with the same.

Diller[8] describes an improved form of Smeeth's separating tube for the separation of rock powders by means of heavy solutions. The new tube possesses several advantages over the Harada and the Brögger tubes.

Petrographical Notes.—The reciprocal relations existing between hornblende and augite in plutonic and volcanic rocks is explained by Becke[9] as due to the fact that hornblende contains a small percentage of constitutional water in its molecule, and that it can therefore be formed only under certain conditions of pressure and temperature when water is present in a magma. When the conditions of pressure and temperature are not right augite forms in place of hornblende. A figure showing curves exhibiting the possibilities of formation of the two minerals explains the author's views.

A massive holocrystalline rock composed of biotite, cyanite and cordierite, with apatite and rutile as accessories, was discovered by Mc

[7] Neues Jahrb. f. Min. B.B. X, 1896, p. 412.

[8] Science, June 12. 1896, p.

[9] Sitzb. deutsch. naturw.-med. Ver. f. Böhmen. Lotos, 1896, No. 5.

Mahon[10] as a bowlder in the bed of the Satlej River near Wangtu in the N. W. Himalayas. It is regarded as a product of contact action. Its original form is thought to have been diabasic or basaltic.

In the pre-Cretaceous, Cretaceous and Eocene beds of northwestern Oregon, Diller[11] finds glaucophane schists, sandstones, limestones, basalts, tuffs and shales.

The granophyres of Strath, Skye, according to Harker[12] are filled with gabbro inclusions where they intrude a great mass of volcanic agglomerate. They are denser and darker than the normal granophyres lying north of them, in which no basic inclusions are known. The gabbro debris in the granophyres is more or less dissolved, those fragments that have most nearly disappeared being represented by isolated grains of augite, hypersthene, altered olivine, magnetite and occasionally plagioclase. The pyroxenes have suffered greater or less change into hornblende and the olivine into pilitic amphibole. The new rock formed differs from the normal granophyre in its structure, in that it appears to contain nests of secondary minerals. Other fragments besides gabbro were also noticed in the same rock.

In the course of an article on the mineral deposits of the Central Alps, Weinschenk[13] describes the granite, gneiss, aplite, lamprophyre, mica-schists, quartzite, amphibolite, serpentine and other rocks of the Hohen Tanern.

BOTANY.[1]

The Metric System in Botany.—The recent appearance of two very important works on North American botany, viz., "Gray's Synoptical Fora of North America, Vol. I, part I" and "Britton and Brown's Illustrated Flora of the Northeastern United States and Canada, Vol. I," in which the English units of measurement are used throughout, suggests the necessity of some missionary work among American botanists. Can it be possible that the botanists of this country are the most conservative of our scientific men? We take part from time to time in the action of the American Association for the Advancement of Science, in which in vigorous and logical sentences

[10] Min. Magazine, XI, p. 141.
[11] 17th Ann. Rept. U. S. Geol. Survey, Pt. 1, p. 14–16.
[12] Quart. Jour. Geol. Soc., May, 1896, p. 320.
[13] Zeitschr. f. Kryst., XXVI, p. 22.
[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

we express our admiration for the metric system and our conviction that the United States Congress is derelict toward this important matter. We urge Congress to make the use of this system compulsory, and yet we go on calmly writing books in which we use the most antiquated of measuring units. Not content with using feet and inches, we express fractions of inches in lines! We vote enthusiastically that mechanics, surveyors, farmers, statisticians and schoolmasters shall use the metric system exclusively, and yet we, the botanists, who of course are "the salt of the earth" are slow in doing what we so urgently recommend others to do. The writer hereof must plead guilty to his full share of blame in this matter in the past, but he wishes to assure his botanical friends that he does not intend to inflict a long suffering public with any work whose use will *compel* a retention of the old units, as in the case of the books referred to above. Nor are these the only books which offend in this important matter; they are singled out because of their great excellence in other respects, and also because such an anachronism was not to be expected in them. Following their lead, however, we may look for many little books with English units; thus it happens that the very books which should familiarize the people with the metric system, the semi-popular and popular books, serve to perpetuate an obsolescent, and what we say we hope will soon be an obsolete system.

It is not necessary to point out the commendable exceptions to the rule; we may, however, mention the botanical publications of the United States National Herbarium, all of whose contributions, if we mistake not, conform rigidly in this respect to the demands of modern science.

The writer would urge that every botanical writer insist upon the use of metric measurements throughout, in some cases with the English equivalents in parentheses, and that the editors of our botanical journals and other scientific journals in which botanical papers are published lead the way in requiring conformity to this rule. If our academies of science and other scientific societies also will insist upon the use of metric units, the present humiliating condition will rapidly disappear.

CHARLES E. BESSEY.

Eaton and Faxon's North American Sphagna.—A short time ago a most important distribution of Peat mosses (*Sphagnaceæ*) was made by Mr. George F. Eaton. In 1893, Professor D. C. Eaton and Edwin Faxon announced the intended preparation of a set of dried specimens of all the North American species. Since that time

the work has gone forward, retarded greatly by the death of Professor Eaton in 1895, whose son then undertook to bring it to completion. It is now issued under the title "Sphagna Boreali-Americana Exsiccata," and includes 172 numbers representing 39 species, distributed as follows:

I. ACUTIFOLIA.—*S. girgensohnii* Russ., *S. fimbriatum* Wils., *S. russowii* Warnst., *S. warnstorffi* Russ., *S. tenellum* (Schimp) Warnst. *S. fuscum* (Schimp) Klinggr., *S. quinquefarium* (Braithw.) Warnst., *S. acutifolium* (Ehrh., e. p.) Russ. and Warnst., *S. subnitens* Russ. and Warnst., *S. tenerum* (Aust.) Warnst., *S. molle* Sulliv. (62 specimens, representing many varieties).

II. SQUARROSA.—*S. teres* Angstr., *S. squamosum* Pers. (10 specimens and several varieties).

III. POLYCLADA.—*S. wulfianum* Girg. (3 specimens including two varieties).

IV. CUSPIDATA.—*S. macrophyllum* Bernh., *S. floridanum* (Aust.) Card., *S. lindbergii* Schimp., *S. riparium* Angstr., *S. cuspidatum* (Ehrh.) Russ. and Warnst., *S. dusenii* (C. Jens) Russ. and Warnst., *S. recurvum* (Beauv.) Russ. and Warnst., *S. fitzgeraldi* Renauld, *S. molluscum* Bruch. (39 specimens, including many varieties).

V. RIGIDA.—*S. compactum* DC., *S. garberi* Lesq. and James. (8 specimens, including several varieties).

VI. SUBSECUNDA.—*S. pylaesii* Brid., *S. obesum* Wils., *S. subsecundum* Nees, *S. platyphyllun* Warnst., *S. contortum* Schultz, *S. rufescens* Bryol. Germ., *S. orlandense* Warnst., *S. microcarpum* Warnst. (26 specimens, including many varieties).

VII. CYMBIFOLIA.—*S. portoricense* Hampe, *S. imbricatum* (Hornsch.) Russ., *S. cymbifoliam* Ehrh., *S. papillosum* Lindb., *S. medium* Limpr., *S. ludovicianum* (Ren. and Card.) Warnst. (24 specimens, including many varieties).

A personal examination of this set shows it to be in every way satisfactory, the specimens being ample and prepared with exquisite neatness.—CHARLES E. BESSEY.

The Cell Nucleus.—The latest contribution to our knowledge of the plant cell nucleus is from the hands of Dr. Zimmermann of the University of Berlin. His "*Morphologie und Physiologie des pflanzlichen Zellkernes*" is destined to be one of the most useful of books, for in it he has brought together what has been made out as to the nucleus both structurally and physiologically, for all groups of plants. In the first

part of his book he takes up methods, chemistry of the nucleus, histology of the nucleus, nuclear division (karyokinetic and direct division), physiology of the nucleus, etc. In the second part the subject is taken up from the systematic standpoint, the structure and division of the nucleus being discussed for each group of plants, e. g., Angiosperms, Gymnosperms, Pteridophytes, Bryophytes, Fungi, Algæ and Schizophytes. The author has summarized the results of the investigations, and apparently given the essential facts. In all cases he makes a direct citation of the particular paper to which he refers, thus enabling the student to verify the statements made by the author. It must not be supposed, however, that the work is a mere compilation; on the contrary the author has wrought into it a great deal of his own matter, so the book is full of fresh material. It will at once find a place in every laboratory, and we hope will be made still more useful by a good English translation.—CHARLES E. BESSEY.

Another Australian Curiosity.—Some time since we reviewed an article on a strange Australian fungus which appeared to be a peculiar edible sclerotium. A recent paper[2] describes what the authors call "a stone-making fungus" for which a new genus is erected. This genus appears to us, however, of doubtful validity, and illustrates a tendency to the multiplication of genera founded upon slight and unimportant characters, which is being carried to the extreme by many of our systematic botanists and which it seems to us should be condemned. *Laccocephalum* is said to differ from *Polyporus* "in being hard and woody from the first, in the peculiarly pitted pileus and in the character of the spores." The most striking peculiarity to the superficial observer, however, is a large stone like nodule at the base of the stipe. This has a diameter equal to or exceeding that of the pileus, and is apparently composed of sand agglutinated and held together by the mycelium into a mass resembling a concretion of ferruginous sandstone.

In the specific description there are apparently some typographical errors, as the spores are said to be "44–50 inches in diameter" (meaning μ probably) with spines "3 inches long" (μ?). The paper is accompanied by a good lithographic plate giving three views of one of the plants.—C. L. SHEAR.

[2] D. McAlpine and J. G. O. Tepper: A New Australian Stone-making Fungus (*Laccocephalum basilapuloides*), Proc. Roy. Soc. Victoria, 1894, Art. XIV.

ZOOLOGY.

Amœba coli not Pathogenic.—This *amœba* has been met with by Sig. O. G. V. Casagrandi and Sig. P. Barbagallo-Rapissiardi[1] in cases of typhoid diarrhœa, simple intestinal catarrh, and in spasmodic dysentery, as well as in healthy persons, and the conclusions drawn were that it is not pathogenic but is a very useful guest, destroying the other organisms living in the intestine. Experiments with cats show that diarrhœa does not develop unless the intestinal canal is already in a catarrhal condition. *Amœba coli* will develop in them, but only because the dysenteric material injected sets up at the same time the condition necessary for development.

Bipalium kewense.—Mr. Woodworth's notes induce me to place on record the probable occurrence of this phanarian at Kingston, Jamaica. Some years ago, when resident there, I had brought to me an example which accorded perfectly with my recollection of the creature, which I had formerly seen at Kew. The longitudinal markings were distinct. While I have no serious doubt of the identity, I was ill at the time of receiving the specimen, and failed to give it the attention it deserved.—T. D. A. Cockerell, Mesilla, N. M.

Egg-Laying in Sagitta.[2]—In the case of *Sagitta hispida* Mr. F. S. Conant finds that the process of egg-laying takes place in the morning, in this respect differing widely from *Sagitta bipunctata*, which deposits its eggs at about sunset, as observed by Fol, and agreeing with *Sagitta hexaptra* as noted by Grassi. Variations in temperature affect the time somewhat, cold retarding the process.

The ova pass through the wall of the germinal epithelium into the oviduct, apparently through interspaces in the wall of this, undergoing by the way a progressive series of changes in shape. In the oviduct the ova remain from 20–30 minutes, their gelatinous envelope thickening meanwhile. Contractions of the ovary result in pushing the eggs backward towards the external opening, and when the pressure has become sufficient the plug closing this is forced out and the eggs are extruded in two linear rows (one on either side the animal) of only a few or as many as 60–70 eggs each. This does not differ essentially from the

[1] Catania, 1895. See J. R. M. S., p. 429.

[2] Ann. Mag. Nat. Hist., XVIII, pp. 201–214. Johns Hopkins University Circulars, xv. (1896) p. 82–4.

act of laying, as seen and described by Boreri in *S. bipunctata*, the sausage-form that these eggs pass through being given them in the latter case by pressure while still in the ovary.

Mr. Conant was unable to determine definitely the location where fertilization takes place, but supports Hertwig in affirming contra Grassi that no spermatozoa are found in the ovary. What little evidence he has indicates that fertilization takes place while the ova are in the duct between the exterior opening and the opening of the duct of the receptaculum seminis. Self-fertilization seems impossible.

The eggs when laid become attached to the sides of the dish by a gelatinous substance that facilitates handling, but collects dirt. In warm weather development to hatching takes place in about 36 hours, and then the animals are miniatures of the adult form, and all are as ready to devour their comrades as are the mature animals.—F. C. KENYON.

The Chætognaths of American Waters.—In his paper just cited Mr. Conant gives nine species as the total number known to occur in American waters. Among them he enumerates five new species added by himself. One of these has caused him to make some very pertinent remarks concerning the divisions of the old genus of *Sagitta* into *Sagitta*, *Krohnia*, and *Spadella*. He agrees with Béraneck's criticism of the systems proposed by Langerhans, Hertwig, and Grassi, and like this author concludes, though under protest, to follow with Strodtmann the arrangement proposed by Langerhans. It would have been much better, however, had he obeyed the impulse that his new species produced, and described all nine as species of *Sagitta*, instead of sandwiching species of *Krohnia* and *Spadella* in irregularly between undoubted species of *Sagitta*. Or he might at least have placed the terms *Krohnia* and *Spadella* in parenthesis.

But, notwithstanding the doubt that arises as to which of the older arrangements to follow in placing Mr. Conant's new species, it should be remembered that after all any system of classification is very largely for convenience, and that in the present state of our knowledge, not only of this particular group of animals but of the fundamental laws governing the evolution of one form from another, any system proposing to show genetic relationship is at least only tentative, and often weakly so at that. In this particular case whether we should regard the number of fins with Hertwig, the so-called teeth, or with Strodtmann and Béraneck, the sum of the characters as the determining features is still a doubtful matter. Judged from the standpoint of convenience the ar-

rangement given by Hertwig seems the best, and for that reason, if not for the sake of showing true genetic relationships, the synopsis below is given.

A. With caudal and with one pair of lateral fins, *Spadella.*

a. Anterior teeth wanting.
Posterior teeth many. Seizing-hooks 8–9. Length 35 mm. (According to Möbius). Taken off Martha's Vineyard, North Atlantic, *S.* (*Krohnia*) *hamata* (Möb).

b. Anterior teeth present.

1. Seizing-hooks 6. Anterior teeth 3–5; posterior teeth 5–7. Length 52 mm. North Atlantic. Lat 42°, 28′; long. W. 50°, 55′, 30″, *S. maxima* Con.
2. Seizing-hooks 10. Anterior teeth 8; posterior teeth 18. A broad bilateral outgrowth of the epidermis distinguishes this from all others. Bahamas (Binnini), Messina, Naples, Madeira and Canary Islands. Length 10 mm., *S. draco* (Krohn) Langer

B. With caudal and with two pairs of lateral fins, *Sagitta.*

a. Posterior teeth wanting. Second pair of fins split posteriorly into 4 villus-like processes. Seizing-hooks 8. Anterior teeth 4–6; corona ciliata forming a peculiar triangle on head and neck. Tail equal half total length. Bahamas (Binnini). Length 4 mm., *S. schizoptera* Con.

b. Posterior teeth present. Fins entire.

1. Seizing-hooks 7–8.
   a. Anterior teeth 3–4; posterior teeth 4–7. 2 external intestinal diverticula. Length 24–34 mm. Martha's Vineyard, Atlantic and Pacific Oceans, *S. hexaptera* (Orb.).
   b. Anterior teeth 4–5; posterior teeth 7–10. No diverticula. Length 5.25 mm. Jamaica, *S. tenuis* Con.
2. Seizing-hooks 8–9.
   a. Anterior teeth 4–5; posterior teeth 8–15. Caudal segment one-third total length. Length 7–11 mm. Jamaica, Bahamas, N. Carolina, *S. hispida* Con.
   b. Anterior teeth 7–8; posterior teeth 10–12. Corona ciliata confined to head. Length 13–18 mm. Bahamas, *S. flaccida* Con.
4. Seizing-hooks 9–12.
   Anterior teeth 5–7; posterior teeth 12–15. With both external and internal intestinal diverticula. Length 16–33 mm. Vineyard Sound, Gay head on English coast, *S. elegans* (Ver.).

—F. C. Kenyon.

New Central American Diplopods.[3]—Among a lot of chilopods and diplopods that Dr. Filippo Silvestri describes as collected by Dr. Festa at Guayra, Darien and Cuenca he describes the new species *Archispirostreptus guayrensis, Plusioporus festæ, Rhinocricus diversicauda, Oxypge varicolor, Ortomorpha festæ, Aulocodesmus angustalus.*

The genera *Oxypyge* and *Alocodesmus* are new. The former approximates very closely to *Rhinocricus*, but differs from that in having the anal valves produced into long straight spines. The latter approaches Pocock's *Odontopeltis*, but differs in the position of the pores, in the granular surface and the dorsal sulcus.—F. C. KENYON.

The development of the Wing-scales and their pigment in the Lepidoptera.[4]—The scales of the wings of Lepidoptera are shown by Mr. A. G. Mayer to be developed from modified hypodermis cells like the hairs of other arthropods. The pigment comes from the so-called pupal blood by a series of chemical changes. The colors of the adults are not formed at once, but all pass through a series, the first of which is a dull ochre-yellow. He succeeded by chemical means in making pigments from the pupal-blood or hæmolymph that were similar in color to the colors of the adult insects. These pigments react to chemical agents similarly to the pigments of the insects.

Dull ochre-yellows and drabs such as one finds among the nocturnal Lepidoptera are the oldest, the bright yellows, reds, and greens of the diurnal forms are derived by a complicated chemical process brought about in the parts most exposed to the light.—F. C. KENYON.

Rapid Growth of Apus.—From Spencer and Hall's[5] account of the crustacea of central Australia we learn that not more than two weeks, and probably only a few days after the fall of rain, specimens of *Apus* were found measuring 2½ to 3 inches in length. When it is remembered that the eggs of *Apus* must pass through a stage of drought before they will develop, this enormously rapid growth is truly remarkable. And the evidence of it is conclusive, if it be impossible for the mature or nearly mature form to pass through the period of drought, which certain forms, e. g., *Astacopsis* and *Telphusa* are known to be able to do.—F. C. K.

Steindachneria.—In 1888 the name *Steindachneria* was twice used to designate new genera of fishes.

Goode and Bean in Agassiz, Three Cruises of the Blake II, p. 26 (April, 1888) used the name for a macrurid taken by the Albatross off

[3] Bull. Mus. Zool. Anat. Comp. Univer. Torino., XI.
[4] Bull. Mus. Comp. Zool., XXIX, 209-36, 7 Pls.
[5] Horn Scientific Exp., 1896, pt. II. J. R. M. S., p. 410.

the delta of the Mississippi River. The fish was mentioned in the following language: * * * *Steindachneria*, a macruroid with a high differentiated first anal fin, has been obtained by the "Albatross" in 68 fathoms." No specific name and no figures were published.

We used *Steindachneria* for a silurid genus inhabiting the rivers of southeastern Brazil in a paper issued July 18, 1888 (Proc. Cal. Acad. Sci. 2d. Ser., Vol. 17). The name was defined and referred to a described species. Mr. S. Garman called our attention to the previous use of *Steindachneria* by Goode and Bean. An examination of Goode and Bean's note showed that their name was a nomen nudum, neither described nor referred to any published species. On learning this we wrote Dr. Goode an apologetic note calling his attention to these facts and received the following in reply. "*Steindachneria* has never been published, though the diagnosis of the genus has been lying in MS. for nearly two years. So we will change the name. It is not of the least consequence." This was under date of Oct. 1, 1888. This intention to change the name was never carried out and in "Oceanic Ichthyology" (p. 419) which has just been received, *Steindachneria* is still retained for the macrurid and reference made to "Three Cruises of the Blake." The name *Steindachneria* being preoccupied for the cat fishes I would suggest the name *Steindachnerella* for the macrurid to carry out the idea of honoring the Custos of the Imperial Zoological Museum of Vienna.—C. H. EIGENMANN.

Mutilations of the Oregon Redfish.—The sores, frayed-out fins, and other mutilations which have been noticed upon the Chinook salmon and redfish by every one who has ever seen these fishes upon their spawning-grounds have been regarded by all as being due chiefly, if not wholly, to the injuries incident to the long journey from the sea. Coming so these Idaho lakes from the sea requires a journey of more than 1000 miles, and it is, in large part, through swift and turbulent waters and up dangerous rapids, cascades, and waterfalls against whose ragged and jagged rocky walls and bed the fish would often be thrown by the seething currents. That they could make this long and perilous journey unscathed could scarcely be believed.

In the shorter coastal streams of Oregon, Washington, British Columbia, and northward, the same mutilations have been observed and have usually, without sufficient reason, been attributed to the same cause. Until now it has, therefore, generally been held that the injuries are received by the fish while en route to the spawning-grounds. Our continuous series of observations at Alturas Lake during the entire period

of the breeding season shows, however, that this is not the true explanation. Among the hundreds of redfish that we examined as they came up into Alturas Inlet from the lake not one possessed any sores, or had the fins frayed out in the least; every one was perfect in every way, so far as mutilations were concerned. Not only were all of those caught on the gill nets as they came up from the lake free from sores, but no sores were seen on any of the fish in the creek until some time after the spawning had begun. The first fish were seen July 24, but not until August 10 were any mutilated ones observed, and then only 3 out of 84 examined showed any considerable mutilations.

In marked contrast with this perfect condition of the fish as they arrive upon their spawning ground is that observed toward the close of the spawning season when scarcely a fish can be found whose fins are not badly frayed and upon whose body are not one or more large sores.

The manner in which the mutilations are really received was readily determined by watching the fish while spawning. The spawning-beds are usually in very shallow water, often only a few inches deep. These beds are of fine granite gravel and sand. There is more or less definite pairing off of the fishes, and each pair usually does all its spawning on a certain area, which may be called the nest. The gravel and sand of this area are moved about and piled up somewhat in heaps or rows as the fish scoop out shallow depressions in the bed; this scooping or moving of the gravel is done as the fish swims upstream over the bed with a rapid quivering motion of the body; during this act the body is always inclined to one side and the gravel is chiefly pushed in the other direction; after swimming across the nest in this way, the fish circles around downstream and returns to the bed to repeat the process again and again, keeping it up for several days. During all this time the male follows closely behind the female, sometimes quivering and plowing through the sand and gravel in the same way and thus receiving mutilations of the same character. Often the back of the fish is turned against the gravel and becomes worn. On each spawning-bed are usually several supernumerary males, and among them and the paired males there is much chasing about and some fighting which results in still further mutilations. It may, therefore, be positively stated that the sores and mutilations seen on the redfish at the Idaho spawning-grounds are practically all received after the spawning season begins (B. W. Everman in U. S. Fish Commission Bull. for 1896, Art. 2.)

On the Occurrence of the genus Reithrodontomys in Virginia.—On December 6, 1896, I trapped an adult male Harvest

Mouse, *Reithrodontomys lecontii* (Audubon and Bachman) at Fort Myer, Virginia. The trap was set under a fence between cultivated fields and a strip of woodland. I believe this is the most northern point on the Atlantic coast at which a specimen of this genus has been taken; and I know of no published record of its occurrence in the State of Virginia or in the District of Columbia. This specimen is number 83,298 of the United States National Museum collection.—Louis Zerega Mearns.

Inheritance of the Monodactyly in the Pig.—The monodactyly, observed in the pig by Aristotle, has persisted to the present time. M. Vasilesen, Professor of Zoology in the Veterinary School at Bucharest, has had the progeny of a male monodactyle pig under observation for a number of years. He notes that of 54 descendants 39 are monodactyle and 13 bidactyle. M. Vasilesen concludes from these observations that the monodactyly of the pig is a hereditary tetralogical phenomenon, susceptible of being transmitted from one generation to another, reproducing itself indefinitely. (Revue Scientif., Oct., 1896.)

Preliminary Description of the Newfoundland Marten.—The marten has long been known as an inhabitant of the Island of Newfoundland, being given by Henry Reeks in 1870 (under the name *Mustela americana*) in his list of the Mammals of Newfoundland.[6]

[6] The Zoologist (London), 2d Series No. 54, pp. 2033-2049, March, 1870; No. 67, April, 1871, pp. 2540-2553. Notes on the Zoology of Newfoundland. By Henry Reeks.

No. 54, March, 1870, p. 2037, reads as follows:

"*American Sable, Mustela americana, Turton; Pine Marten; Marten Cat* (Newfoundland).—Still common in various parts of the island, but from the increasing, or, at any rate, present value of the fur is annually becoming scarcer. It is a bold rapacious animal, and in its habits remind one much of the common polecat (*M. putorius*). One of the specimens I obtained entered the house of a settler and carried off a dead duck (*Anas obscurus*), but was subsequently shot in a tree near the spot, in fact, while returning for a second duck, having probably hid the other. Marten cats are easily caught by iron traps placed in "cat-houses," or in "dead-falls." Without attempting to settle, or even discuss, the vexed question as to the identity of this species with the European, *M. zibbellina*, I may here state that very little reliance can be placed on the colors of the Martinæ, as a very appreciable difference exists in this particular, even in specimens obtained in Newfoundland and the Labrador, the former being much lighter throughout, but especially about the head and ears. So perceptible is the distinction that a trader readily separates the Newfoundland skins from those obtained on the mainland."

Like most of the mammals of this island it is, however, very different from its mainland cousin, and as no possible connection can now exist between it and the continental form it must rank, a full species, as

MUSTELA ATRATA SP. NOV.—Type from Bay St. George Newfoundland, No. 5752 ♀ adult, coll. of E. A. and O. Bangs. Collected by Ernest Doane Sept. 29th, 1896. Total length 548, tail vertebræ 185, hind foot 89, ear from notch 43.

General Characters.—Size about that of *M. americana* (probably somewhat larger); color very different, suggesting a dark colored mink, rather than a marten; skull slightly different:

Color.—Deep chocolate, becoming black on back, head, arms, legs, rump and tail; a few white hairs scattered along back; chest and under side of neck irregularly blotched with orange; a median line of orange on belly; ears black narrowly bordered all round with dull white; a patch of yellowish-white hairs in front of opening of ear.

Cranial Characters.—Skull about the size or larger than that of *M. americana;* rostrum narrow; audital bullæ much larger and deeper than in *M. americana* and with a more marked "bottle-nose" projection; dentition rather weaker throughout, with greater spaces between premolar teeth, than that of *M. americana.*

Size of the type skull, ♀ "middle aged', adult: Basilar length 69.2; zygomatic breadth 42; mastoid breadth 34.2; breadth across roots of canine teeth 14.2; greatest length of single half of mandible 49.6.

Size.—The type ♀ adult; total length 548, tail vertebræ 185, hind foot 89, ear from notch 43. Of an adult ♀ prolotype, (No. 5751 Bangs coll.). Total length 559; tail vertebræ 185, hind foot 86, ear from notch 41.

Remarks.—The above description is based upon two beautiful skins accompanied by skulls, both "middle aged" adult females. Neither has the fur quite "prime," both being taken in September. In its full winter dress, this marten must be a superb creature.

There is a series of eleven skulls of *M. atrata* in the collection of the Museum of Comparative Zoology, at Cambridge, Mass. collected in Newfoundland in 1865 by James M. Nelson. I have examined these and find some of them to be old adults, but all are unsexed. They bear out the characters claimed for *M. atrata*—the large, peculiarly shaped audital bullæ, and the weak dentition, and would seem to indicate that *M. atrata* is a larger animal than *M. americana.*—OUTRAM BANGS.

Zoological News.—According to F. Neri,[7] who has been studying the beaks of cephalopods, these structures are composed of fibrous cuticular laminæ, which chemically are not chitinans but keratinous. The upper part is encrusted with lime.

The results of the Austrian deep sea expeditions of 1890–4 show, according to Dr. R. Sturany,[8] that the eastern portions of the Mediterranean is much poorer in deep sea shells than the western basin, and further, that the fauna is doubtless of Atlantic origin.

ENTOMOLOGY.[1]

The American Spring-tail.—This very anomalous little insect (*Lepidocyrtus americanus* Marlatt) measuring scarcely more than one-tenth of an inch, silvery gray in color, with purple or violet markings, may be frequently observed in houses. In common with the silver fish, it belongs to the order of insects known as Aptera (wingless), from the fact of their having no vestige of wings throughout life.

The simple structure of these insects, and particularly their resemblance to the larval state of winged insects, has led to the belief that they are the primitive forms of insect life. That this is true is, however, by no means certain, and they may rather be degraded or debased examples of some of the higher orders of insects. The species figured herewith is not infrequently found in dwellings in Washington, but is apparently undescribed, and, in fact, little is known of the American species. It is, however, closely allied to a European form (*L. cervicalis*), often found in cellars, and figured by Sir John Lubbock in his monograph on these insects. Another allied European species (*Seira domestica*) has been named from the fact of its being a frequenter of houses.

These insects belong to the suborder Collembola, which (following Sharp) is distinguished from the other suborder of Aptera, Thysanura, by having but five body segments instead of ten, and possessing a very peculiar ventral tube on the first segment, and commonly also a terminal spring, by means of which these creatures leap with great agility, and from which they take their common name of "spring-tails."

[7] Atti Soc. Tasc. Sci, Nat., x (1896), J. R. M. S., p. 401.

[8] S. B. K. Akad. Wiss. Wein., 1896. J. R. M. S., p. 400.

[1] Edited by Clarence M. Weed, New Hampshire College, Durham, N. H.

These insects, though very abundant, have been very little studied, and little is known of their life habits. They often multiply in extraordinary numbers, especially in moist situations, swarming on the surface of stagnant water or on wet soil. They seem to be very tolerant of cold, and we have interesting accounts of the occurrence of a species related to this one in the Arctic regions on melting snow fields and on glaciers, where they are known as "snow fleas" or "snow worms." Other interesting forms occur in caves, and in the Mammoth Cave in Kentucky they are notably abundant. In houses they may often be found on window sills, in bathrooms, and sometimes, under favorable situations, in very considerable numbers. Especially are they apt to occur where there are window plants or in small conservatories, but are not confined to these situations. Very little is known of their food habits, but they are supposed to subsist on refuse or chiefly decaying vegetable matter.

The striking peculiarities of these insects are in the remarkable ventral tube and the strong saltatorial appendage of the extremity of the body. The first arises from the forward body segment, and seems to act in this species as a sort of a retainer for the leaping organ, or spring proper. It is said to secrete a viscid fluid, which enables the insect to better adhere to smooth vertical surfaces. The so-called "catch," or retainer proper, is shown in a small projection between the hind pair of legs and the spring, and grasps the latter near the middle. The springing organ is two-jointed, the last joint being bifurcate, and its terminals inclosing the ventral tube.

These insects can not survive dryness, and, while they will not often occur in sufficient numbers to be particularly objectionable, the removal of the moist objects or surfaces on which they congregate and the maintenance of dry conditions will cause them to soon disappear.—C. L. MARLATT *in Bulletin, No. 4, U. S. Division of Entomology.*

Sphinx Caterpillar Surviving Ichneumon Attack.—Rev. T. A. Marshall records[2] an interesting case of this kind. A caterpillar of *Acherontia atropos* had been 'forced' by artificial warmth to an early development of the moth. The latter was a perfect specimen; in its abdomen was found a large Ichneumonid larva. "From the caterpillar point of view we have here only an instance of tenacity of life under trying circumstances. * * * In the normal course of things the death of the Atropos larva after its change to a chrysalis, and the production of a living ichneumon, would inevitably have taken place sometime

[2] Ent. Monthly Mag. Dec., 1896.

next spring. But the development of the chrysalis having been artificially hastened, the parasite had no time to cause its death, and the exhaustion of vital juices was not sufficient to prevent the final metamorphosis. Hence the phenomenon of a half-grown parasite being found in the body of a perfect moth.

"The eventual death of the moth from the action of the parasite is probable, but not quite certain. It would seem to depend upon two doubtful questions: (1) What is the natural duration of the life of an Atropos? and (2) Would the robust constitution of which proof has already been given, enable it to hold out till the parasite had escaped from its body? The single perforation of the cuticle necessary to permit the issue of the ichneumon might not be mortal in its effects. The fatal result in other cases is believed to depend partly upon the breaking up of the tracheal system by numerous perforations, and partly upon exhaustion of the vital forces. The moth in question would only be subject to the first of these injuries in a very mild degree; and its great bulk and strength might enable it, as heretofore, to defy the second. It seems, therefore, not unreasonable to suppose that, if left to nature, it would ultimately have recovered."

A Viviparous Ephemerid.—M. Causard records[3] the following interesting observations the Ephemerid *Chlœopsis diptera* Latr. "This species is very common in houses at the end of summer and the commencement of autumn, when these insect attach themselves to the windows or the ceilings, and there rest immovable, their two wings turned back, and applied one against the other, the posterior part of the abdomen terminated by two long filaments, turned back upon the dorsal aspect. The same insect may be observed in the same place for several days. Having captured a large number of them, I have been able to keep them for more than three weeks before they laid their eggs. I have found it impossible to fix exactly the duration of their existence, because at the time of capture I did not know how long they had emerged from the nymph state. However, that may be, there are Ephemeræ which have but little title to the name. This relatively long existence in the adult state is in accord with their processes of reproduction.

"Desiring one day to study the circulation of the blood in one of these insects, in the living state, which I supposed to be sufficiently transparent for the purpose, I took one of them and placed it between two plates of hollowed glass. The pressure of these plates caused a

[3] Comptes Rendus, CXXIII, 705; Ann. and Mag. Nat. Hist., v, I8, p. 481.

quantity of greyish matter to exude from the abdomen of the animal; I regarded the insect as dead and my observation a failure. Nevertheless, on examination with the microscope, I observed that the extruded matter was formed of a large number of little ovoid bodies, which immediately began to move about and unroll themselves. Each of them was a little larva, which was very active and began to swim about. Were these Ephemeræ viviparous? This was the question that I at once asked myself. Then I examined the contents of a large number of individuals, and I found eggs in every stage of development; in some the segmentation was but slightly advanced, but a commencement of evolution was very distinct; in others, the extruded larvæ showed segmentation; the most advanced enclosed completely developed larvæ, but still enclosed in the transparent membrane of the egg. I have since been able to observe the females emitting their larvæ freely without any pressure, so that their viviparity is a proven fact. When the moment approaches that the insects seek the water, they allow themselves to fall into it and float on the surface, with their wings extended, up to the moment at which the larvæ are extruded. During this operation, which lasts for a very short time, the whole of the last three segments of the abdomen are lifted upwards so as to form almost a right angle with the rest of the body. The larvæ are expelled by a double orifice pierced between the seventh and the eighth abdominal rings; these two openings are only separated from one another by a very slight portion of tissue, and generally break into one another so as to become one after the deposition of the egg. There results a large slit which involves the whole of the lower half of the line of junction of these two rings. In this case the digestive tube is burst so that the nerves are detached behind the last nervous ganglion which occupies the seventh abdominal ring. These observations led me to study the female genital apparatus, which ought to be constructed with a view to the internal development of the eggs. Almost the whole of the body of the female is occupied by two sacs attached, the one to the other, along the middle line; the vertical partition which separates them is traversed by numerous tracheæ. These sacs extend over the whole abdomen, with the exception of the last two segments, and reach as far as the head, occupying in the three thoracic rings almost the whole of the space left free by the muscles of the wings and legs. Beneath them is the digestive tube, reduced to a canal with a thin and delicate wall and the nervous chain. These two sacs open on the outside, each by a distinct orifice pierced in the membrane which joins the seventh abdominal ring to the eighth, and, as already described, at the moment of the

exit of the larvæ these two openings run together to form one. To what part of genital apparatus of other insects does this double incubation sac correspond? I have not yet been able to settle this point, in as much as I have only had under observation insects in which the sacs were already filled with eggs in course of development, and in which the empty and shrivelled ovaries were with difficulty visible. In spite of the relatively long duration of their life, the Chlœopses takes no more food in the adult state than the other Ephemeræ. Their mouth is only armed with a few soft and incomplete parts.

"The larvæ are elongated, very active, armed with feet terminated by a single hook. The head, roughly pentagonal in form, bears two long antennæ and five ocular spots of which one, odd, is situated between the bases of the antennæ; the four others are arranged in two pairs, of which the posterior furnishes the reticulated eyes of the adult. The mouth is provided with a masticatory apparatus, which is well formed. The abdomen is formed of ten segments, of which the last bears two long filaments provided with a few stiff hairs. The length of the body is 0.7 millim., not including the caudal filaments, which are at least as long as the body. The cephalo thorax and the anterior part of the abdomen contain at birth brilliant globules, which disappear in a day or two. During the first period of their existenee the larvæ have neither tracheæ nor tracheal branchiæ. Six days after their birth the larvæ undergo a first change; their appearance changes but little, but on each of the 2nd, 3rd, 4th, 5th and 6th abdominal rings there appears a pair of short prominences, each as much developed as the others, the rudiments of the future tracheo-branchiæ. Three days later there is another change; the five prominences just mentioned become elongated, and a pair of them appear on the first abdominal ring, the tracheæ also become visible. After the third change, the five pairs of tracheo-branchiæ are well formed and receive the tracheæ. Those of the first ring do not develop completely until the fourth change, and, finally, those of the seventh abdominal ring, apparent at the third change, are not complete till after the fifth. From that time the larva possesses all its organs."

EMBRYOLOGY.[1]

The Corpus Luteum.—The fate of the Graafian follicle of the Mammal's ovary is certainly very remarkable. The well known corpus

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts reviews and preliminary notes may be sent.

luteum that results from the rupture of the follicle is generally thought to be a growth of connective tissue, for the most part. J. Sobotta,[2] however, finds that in the mouse this structure is formed by the enlargement of the epithelial cells of the follicle, aided by growth of connective tissue. His results are obtained from the very large number of sections used in his previous study of the fertilization and cleavage of the mouse's egg (See AMERICAN NATURALIST Aug. '95) and from the thousands of specimens at his disposal he is able to write a complete history of the corpus luteum.

It is interesting to note that in three cases in which the egg was abnormally retained in follicles that had ruptured as usual when ripe the usual corpora lutea were formed, though of course the egg had not been fertilized. This and other reasons lead the author to affirm that, in the mouse, no distinction can be drawn between corpora lutea vera and corpora lutea spuria, that is to say the yellow body is just the same whether the egg is fertilized or not.

The chief results of this paper may be summarized as follows:

In the ripe Graafian follicle of the mouse the connective tissue sheath is composed of a fibrous outer part and of an inner coat of large, rounded cells; the many-layered epithelium internal to the latter shows mitotic divisions; at the centre is the usual liquid bathing the discus proligerous that envelopes the egg. Both the connective tissue and the epithelial layers are much thinned away on the side next the body-cavity where the rupture is to take place.

When the follicle bursts it happens only exceptionally that blood escapes into its central cavity. The ruptured follicle is at first just like the ripe one except for the loss of the egg, discus proligerous, and the chief part of the liquid. The cleft in its side is very quickly healed over by the union of its epithelial edges.

About an hour after the rupture of the follicle the cells of the inner connective tissue sheath begin to divide by mitosis and liquid is secreted into the central cavity. Migratory corpuscles appear in the inner connective tissue sheath.

In from five to seven hours the growth of this sheath gives rise to fine radiating partition that penetrate the epithelial layers. The inner sheath is used up in the growth of these partitions as they extend in through the epithelium to the central space; leucocytes are found all through the epithelial layers.

After forty to fifty hours the liquid accumulated in the central space has been reabsorbed and its place taken by a small, gelatinous connec-

[2] Archiv. f. Mik. Anat. 47, April, 1896, pp. 261–306.

tive tissue mass; about this the epithelial cells are subdivided by a network formed from the radiating partitions and the leucocytes; the epithelial cells in the meshes of this network are much enlarged but not increased in number, division having ceased at the time of rupture.

The yellow body is complete in from sixty to seventy-two hours. It is then much larger than the original Graafian follicle, as the epithelial cells are swollen to ten times their former size and are intertwined with the newly formed connective tissue bearing a rich network of capillaries. Later more or less fat is deposited in the epithelial cells and the body has a slightly yellow color, but here, as in some other mammals, the name is misleading.

As far as the author's observations go the corpora lutea do not degenerate, in the mouse, but remain unchanged during the life of the animal and thus add much to the size of the ovary.

Cleavage in Ovarian Eggs.—Professor J. Janosik[3] finds in some follicles that atrophy in the rabbit and guinea-pig ovarian eggs may undergo a real cleavage, though of course there has been no fertilization (as far as known). Such ovarian eggs may form small cells very like polar bodies and lying near a true spindle which is in the position of a maturation spindle. This is more common in young than in old animals.

There are cases of true cleavage with few to many nucleated cells and these cells may be of equal size or some large and some small. There are also cases of "fragmentation" where the isolated masses of protoplasm contain no visible nucleus. In these cases of ovarian cleavage the membrana pellucida disappears as it does in the normal cleavage. Such eggs later atrophy with their follicles.

PSYCHOLOGY.[1]

Annual Meeting of the American Psychological Association.—The Fifth Annnal Meeting of the American Psychological Association was held at Boston and Cambridge, on December 29 and 30, 1896. The step taken a year ago of affiliating with the American Society of Naturalists proved so successful that this course has been adopted permanently by the Association. At the present meeting

[3] Archiv. f. Mik. Anat., 48. Nov. 7, 1896, pps. 169–181.

[1] Edited by H. C. Warren, Princeton University, Princeton, N. J.

about 35 members were in attendance, besides a large number of visitors who came to the various sessions. The proceedings as a whole were very interesting. The number of papers offered was too great, however, for the time allotted to the sessions; as a consequence each speaker was limited to 15 minutes, involving in many cases a rather fragmentary presentation of the subject. This gave the meeting a somewhat unfinished and unsatisfactory character, for which the content of the papers was in no wise responsible.

The Association held two sessions for the presentation of general papers, on Tuesday and Wednesday mornings, and a special session on Wednesday afternoon for the reading of the President's Address and the transaction of business. Besides this many members attended the discussion on the Inheritance of Acquired Characteristics, before the American Society of Naturalists, where the psychologists' standpoint was represented in the discussion by Prof. James. The lecture Tuesday evening by Mr. Alexander Agassiz on Deep-Sea Soundings, and the reception afterwards at Mr. Agassiz's house, were largely attended by the psychologists, as was also the Annual Dinner of the Affiliated Societies at the Hotel Brunswick, Wednesday evening.

The session of Tuesday morning, (December 29th), was held at the Harvard Medical School in Boston, and was devoted more especially to the experimental side of psychology. The proceedings opened with a paper on the "Physiology of Sensation," by Dr. E. A. Singer, and one on the "Intensity of Sensation," by Mr. J. E. Lough. Both speakers discussed the physical bases of sensation differences. According to Dr. Singer, the data which yield quality distinctions are physiological, and depend on functional differences of the end-organs; while the intensity data, on the other hand, are physical, depending directly on the intensity of the external stimulus. Mr. Lough discussed various theories of intensity, and took the position that the intensity characteristic depends on the greater or lesser prolongation of the stimulus. The maximum intensity effect of a particular stimulus is reached only by passing through a series of neural effects which are the maxima of other lesser stimuli. With a duration less than that which is required to produce this maximum, the effect is a lessened intensity. The speaker reported a series of experiments whose results substantiated this view. Two slits of different breadths were arranged one above the other in a pendulum, so as to admit light and cast two bright images on a reflector. These two images were of the same size and objective brightness; when the pendulum swung, they appeared at the same instant, but one lasted twice as long as the other. It was found that up

to a certain time of exposure the broader slit gave an effect of about double the brightness of the other. This was taken as the time required for the maximal effect in the larger slit. When the time of swing was further lengthened this difference in intensity diminished and finally disappeared. Mr. Lough drew a parallel between the intensity series and the scale of muscular sensations, though he was inclined to regard the latter as more than a mere intensity series.

Prof. G. A. Tawney reported some experiments on the effect of practice upon the tactual double point threshold, and the so-called 'Vexirfehler.' As a rule he found that any reduction of the threshold was accompanied by an increase in the number of Vexirfehler. His experiences with different subjects indicated their division into three distinct classes. In some subjects there was a large reduction of the threshold as a result of practice, with a corresponding increase of Vexirfehler; this reduction of the threshold was not confined to the regions actually practiced upon nor to their symmetrical points, but there was found to be a sympathetic reduction all over the body. In other subjects there were few Vexirfehler and only slight reductions of the threshold from practice. In others many Vexirfehler occurred from the very beginning, so that it was difficult to obtain any reliable value for the threshold. Suggestion was found to play an important rôle in every instance, and the results varied greatly according to the degree in which the subject was instructed beforehand as to the purpose of the experiment; where any suggestion was carefully avoided no real reduction of the threshold occurred; some of the subjects to whom no intimation of the nature of the problem was given, failed to get any Vexirfehler at all. The whole phenomenon of threshold reduction and Vexirfehler thus seemed to require a psychological rather than a physiological explanation.

Mr. A. L. Lewis, introduced by Prof. Witmer, read a paper on "Comparison of the Times of Simple Reactions and of Free Arm Movements in Different Classes of Persons." His subjects were white men and women, Indians and negroes, both of the latter classes being males. The instrument used was the Hipp chronoscope, which was tested before and after every series, giving constant and variable errors of only 1σ each. Reactions on sound showed the order, from the shortest time upward, to be Indians, white men, negroes, women; the first two classes were between 100σ and 110σ, the last two were between 150σ and 160σ. For visual stimuli the white men gave a reaction time somewhat shorter than the Indians; the time for free arm movement

followed the latter order. In each case the time of the women was considerably longer than that of the white men and Indians.

Prof. Cattell reported upon the work in progress at the Columbia laboratory. He spoke of investigation on the nature of mental imagery. An object is named by the investigator, and the subject reports the order in which the images from different senses are recalled; a passage is read, and the nature of the resulting memory images is investigated in a similar manner. An examination of various poets shows that some, (such as Swinburne), habitually avoid certain harsh sounds, while others, (such as Browning), pay little heed to this point; the former seem better adapted for loud reading, the latter for visual perusal. Prof. Cattell reported another study on the nature, duration, etc., of after images, with special reference to the individual peculiarities of different subjects. The problems under investigation at Columbia include also one on the relation of objective rhythm to the greatest possible speed of voluntary rhythmic movements, one on color nomenclature, and one on the relation between the duration and intensity of light stimulation. According to Prof. Cattell, the results in the last case thus far were not in agreement with those reported by Mr. Lough.

Prof. Witmer read a paper on the "Organization of Practical Work in Psychology." He spoke of the beneficial results to be obtained from the correlation of psychology with medicine and teaching. Up to the present time the results of contemporary psychological investigation have not been scientifically applied, in the instruction of either normal or defective children. Prof. Witmer recommended a number of steps to be taken with a view to accomplishing this end: 1. A series of uniform psychological tests, determined at the outset and not altering constantly with changes of fashion, to be applied everywhere to school children of all grades, and to follow as far as possible the same child throughout its course. Another series, devised in the same way, to be applied similarly to the mentally defective. 2. A permanent exhibit of the results obtained from these tests, and of the methods employed in making them, which should be accessible to teachers and others interested. 3. An experimental training school for the defective classes under psychological auspices. 4. A psychological clinic and dispensary, in charge of an 'expert' with thorough medical as well as psychological training, for children who without any marked mental deficiency are nevertheless backward under the ordinary methods of teaching; children would be brought here for consultation, and after examination the proper treatment or course of training would be recommended.

Miss Mary E. Harmon reported on a series of psycho-physical measurements to which 100 normal school girls and 100 kindergarten pupils of both sexes were submitted. The usual questions of age, parentage, etc., and anthropological measurements, were supplemented by tests of sound reaction, free arm movement time, etc. Among the kindergarten children, the girls were found to be much slower in the arm movement test than the boys, the average times being about 215σ and 155σ respectively.

Prof. Wesley Mills reported on personal experiences under ether. He described the narrowing and intensification of consciousness prior to evanescence, and compared it with De Quincey's similar experiences under the influence of opium.

Brother Chrysostom, of Manhattan College, spoke upon a "Preliminary Study of Memory." A set of 30 questions was distributed among various educational institutions; a few have responded already, and these results were reported. The questions were minute and thorough-going; several were devoted to different characteristics of the attention and its individual variations. One inquiry being as to the time of day in which the best work could be done, the answers were found to be about evenly divided between the forenoon and late evening.

Interesting discussion followed the separate papers, but unfortunately the program was so crowded at both this and the Wednesday sessions that this important part of the proceedings had several times to be cut short.

The meetings on Wednesday (December 30th) were held in the Peabody Museum of Archæology at Cambridge. The morning session was devoted largely to historical and theoretical topics. Prof. Armstrong reported on the growth of the study of philosophy in American colleges in the past twenty-five years; he described the great progress everywhere since 1872 in the number of courses, hours and instructors in the department, the broadening and specialization of the courses, and the increase of special foundations and endowments.

Two papers followed on the relation between mind and body. Prof. D. S. Miller summed up the evidence against the theory of psycho-physical parallelism, and spoke in favor of Bradley's construction of the causal relation. Prof. C. S. Strong, speaking on the same topic, favored a form of the parallelistic theory which recognized the "efficacy of consciousness"; it was a mistake, he argued, to believe that the parallelistic theory necessarily involved the reduction of consciousness to the rôle of an epiphenomenon.

Prof. Creighton discussed the concept of the "Transcendental Ego," and was followed by Mr. F. C. S. Schiller, who examined the nature of "Pessimism," and Prof. James Seth, who discussed the "Standpoint and Method of Ethics." Two papers devoted to logic were given in outline merely. Prof. J. G. Hibben exhibited and explained a set of diagrams by means of which the various forms of immediate inference were generalized and schematized. Prof. A. T. Ormond summed up his position with regard to the negative in logic.

The session closed with a report by Prof. Sanford on a new eye sphygmograph, which furnishes the best available method (apart from vivisection) of measuring the blood supply of the brain. After describing the apparatus, he exhibited diagrams of records obtained by means of it before and after nervous excitation; these were compared with simultaneous records of the wrist pulse.

The afternoon session was devoted to the Address of the out-going President, Prof. Fullerton. The subject of the address was "The 'Knower' in Psychology." Opening with an historical review of the position taken by various thinkers regarding the agent or subject of knowledge, he proceeded to criticise in detail the theories held by Prof. Ladd and other members of the Association. After the address Prof. Ladd replied to the criticism of his own views.

At the business meeting of the Association, Prof. J. Mark Baldwin, of Princeton, was elected President for the ensuing year, and Dr. Livingston Farrand, of Columbia, was re-elected Secretary and Treasurer. Several new members were elected into the Association, and the two annual vacancies in the Council were filled. The committee appointed at the previous meeting (1895) to formulate a system of uniform physical and mental tests, submitted their report, which was not read in full owing to the lateness of the hour. The committee were unable to agree on a complete system of uniform tests; they recommended that for the present considerable latitude be given within certain broad lines, with a view to comparing various tests, so that the best may eventually be adopted.—H. C. W.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The American Society of Naturalists met December 29th, at the Harvard Medical School, Boston. The meeting of the affiliated Societies, was fully up to the standard of previous gatherings, both as to the amount of work accomplished and the attendance. The programs of

the societies were full, the physiologists especially showing an important increase in the number of workers. Several young men presented maiden papers of merit to the morphologists; while the merits of the opposed theories of psychic parallelism and interference in animal evolution were discussed by the psychologists among the topics before them. The discussion of the inheritance of acquired characters was made the subject of the special discussion by the naturalists, and, although the subject is not new, a large audience was present, the other societies, excepting the physiologists, adjourning to attend it. Profs. Minot and James, of Harvard University, took the negative, and Macfarlane and Cope, of Pennsylvania, the affirmative. It was generally regretted that more time had not been alloted to the discussion, so as to have enabled others to take part in it. The evening dinner was closed by an interesting address from the President, Prof. Scott, of Princeton, an innovation which we hope will become the regular custom.

The following is the program of proceedings: Reports of Committees; Election of New Members; Appointment of Special Committees; Discussion, subject: "The Inheritance of Acquired Characteristics;" "Zoology," Prof. C. S. Minot; "Botany," Prof. J. M. Macfarlane; "Paleontology," Prof. E. D. Cope; "Psychology," Prof. Wm. James; Special Papers.

Prof. C. S. Minot opened the discussion on heredity, suggesting the wide interest in the solution of the problem of whether characters acquired during the life of the parent were transmitted to the offspring. It was well illustrated in the popular beliefs that correct habits of life or the opposite, in parents, had an important influence on the character of children, leaving out of the question the force of example. To many the incentive to right living was centered largely on the bearings of the matter on education of the young.

The scientific data, however, on which to base a theory, was most meagre in amount and unsatisfactory in character. Much of the reasoning had to be in assumptions, which were but sparsely indicated in the evidence. The characters generally of an individual were largely the result of many generations of development, and were the last term of a series, each part of which had a causal relation to the result.

Several specific characters were taken up by the speaker, as the development of the facial nerve in the embryo, cases of false articulation forming in luxated joints, characters in the Papilio genus of butterflies, and some other instances. It was urged as an observation that all normal parts, whether hard or colored or otherwise highly differentiated from the germ, seem to follow a predetermined plan in the develop-

ment of the individual, and, in the history of a species, and have a tendency to differentiate in series. The presence of series it was therefore, argued is no evidence of the transmission of acquired characters.

An elaborate presentation of the two theories of the primal unit of life was entered into, detailing first the views of investigators who regarded the start as a small, discrete, homogenous particle gifted with considerable locomotive power, and thus capable of conveying impressions from the outside of the subject to the more remote precincts of the germ within. Opposed to these were theories to which the speaker adhered, which assumed the unit to be the cell, relatively large, of a various chemical constituency and with something of an organization. The first of these two theories permitted the further step of assumption that acquired impressions could, by the greater facility in movement, reach the germ, while the second theory found the germ rather removed from outside impressions, and tending generally to perpetuating the type or the result of accretions from a long previous series of experiences and impressions. Prof. Minot was thus opposed to the idea of transmission as defined in the question.

Prof. J. M. McFarlane was in favor of the theory of transmission, drawing his data from botanical studies in an exhaustive review of the vegetable kingdom. His arguments were directed mainly to examples of changes in genera and species from changes in environment, and a lot of evidence was adduced having some relation to the transmission of acquired characters, but mainly to showing the prompt response in nature to the influence of surroundings.

Prof. Cope's defence of the doctrine of the inheritance of acquired characters was selected from the evidence contained in his book, "The Primary Factors of Organic Evolution." He referred especially to the history of the moulding of the articulations of the vertebrate, and especially the Mammalian skeletons, of which such complete series has been furnished by paleontology. The forms of these articulations he believed to be the result of their movements, for the reason that they could be formed artificially as the result of experiment, or in consequence of luxations. He believed that the resulting forms have been inherited, because they are found in the embryo, before the animal has had an opportunity of developing the structure for himself by interaction with the environment.

He admitted the justice of Dr. Minot's demand for an explanation of this phenomenon. He stated that the preformationists offered no explanation ; and, indeed, so far as he could see, none is possible from their point of view. The epigenesisists could, on the contrary, appeal

to the phenomena of memory as a plausible explanation. Stimuli from without and within the organism leave a record in the brain-cells, which give the form to consciousness when the latter invades them along the guiding lines of association. Why should not the germ plasma be capable of a similar record of stimuli, which is expressed in the recapitulatory growth of the embryo? He thought that the evidence pointed to such a process. These stimuli affected the soma and the germ plasma simultaneously, in accordance with the doctrine of Diplogenesis; but that the soma only records results in each tissue which are appropriate to the functions of the same, while the germ plasma and brain-cells may record them all. The certainty of record in both cases he supposed to depend on the frequency and strength of the impression, as is known to be the case with the memory of the mental organism. Hence mutilations or single impressions were rarely recorded, while those due to the constant and habitual movements are recorded, and furnish the physical basis of growth and of evolution of type.

He further remarked that the belief that natural selection originates structure could not be entertained, as paleontological evidence shows that evolution has proceeded by very gradual additions and subtractions of character, which required long periods to become of any value in the struggle for existence—sometimes an entire geological period being occupied in the elaboration of a character to structural usefulness.

Finally, he referred to the physical mechanism of mental phenomena, and stated that some psychologists require a completed machine in order for the performance of special mental function. The speaker called attention to the fact that it is highly probable that the fundamental sensations do not even require a nervous system for their expression. Thus Protozoa appear to experience the sensations of hunger, temperature and the muscular sense of resistance. Hence, it is as true of the physical basis of mental as of other functions that the formation produces the structure, while structure merely specializes or perfects function.

Professor Wm. James followed from the psychologic point of view. He said that the brain was evidently an organ capable of great variability of function, and that variations in new directions were frequent. He regarded genius as a form of sporting, and that such sports frequently served as guides to the development of human society. He believed that education was of primary importance, and did not find much evidence of the inheritance of characters acquired in this way. He believed on the contrary that mental acquisitions are transmitted

from generation to generation by education and by imitation, a process which Prof. J. Mark Baldwin had termed "Social Heredity."

At 8.15 P. M. the Society attended at the Fogg Museum of Art, Harvard University, Cambridge, a lecture by Mr. Alexander Agassiz, on "The History of Deep Sea Explorations;" and at 9.30 P. M. attended a reception by Mr. Alexander Agassiz, at his residence on Quincy Street, Cambridge.

On Wednesday, December 30th, 12 M., the Society attended at the Fogg Museum of Art, Harvard University, Cambridge, a lecture by Prof. E. B. Wilson, on "Recent Developments of the Cell Theory; at 1.30 P. M. was served at the Faculty Rooms, University Hall, Cambridge, a luncheon, by invitation of the President and Fellows of Harvard College. Two addresses were delivered in honor of the Fiftieth Anniversary of the arrival of Agassiz in Cambridge, by President Elliott and Prof. Wm. James. At 3 P. M., Mr. Alexander Agassiz met the Society in the Museum of Comparative Zoology, and described the Museum; and at 6.30 P. M., Hotel Brunswick, corner of Boylston and Clarendon Streets, Boston, a business session was held. At 7 P. M. the annual dinner of the Affiliated Societies took place at the Hotel Brunswick, at the close of which the societies listened to the address of the President, Prof. W. B. Scott.

American Physiological Society.—Program: Tuesday, December 29th, at the Harvard Medical School, General Business; Reading of Papers: W. T. Porter, "Studies in the Physiology of the Mammalian Heart:" T. Hough, "On the Duration of Cardiac Standstill with Different Strengths of Vagus Stimulation;" R. Hunt, "Some Experiments on the Relation of the Inhibitory to the Accelerator Nerves of the Heart;" W. H. Howell, "Exhibition of Plethysmographic Curves Obtained During Sleep, with Remarks;" H. P. Bowditch, "The Relation between Height, Weight and Age in Growing Children;" C. S. Minot, "An Experiment on Telegony;" S. J. Meltzer, "On the Contraction of the Stomach Produced by Direct Stimulation and by Stimulation of the Vagi with the Faradic Current;" Fr. Pfaff, "An Experimental Investigation of Some of the Conditions Influencing the Secretion and Composition of Bile" (With Mr. A. Balch); G. Lusk, "The Production of Sugar from Gelatine in Metabolism;" W. T. Porter, "Demonstration of a Method for the Isolation of the Mammalian Heart;" S. J. Meltzer, "Demonstration of the Reaction of the Stomach to Faradic Stimulation;" G. T. Kemp, "Demonstration of a Convenient Form of Apparatus to Avoid Explosions in Gas Analysis."

Wednesday, December 20th, at Harvard University, Cambridge, General Business; Reading of Papers: G. C. Huber, "The Structure of the Sympathetic Ganglia of Vertebrates, with Demonstration of Preparations;" G. C. Huber, "Remarks on the Ending of Nerves in Muscle Tissue, with Demonstrations;" W. Mills, "The Functional Development of the Cerebral Cortex in Different Groups of Animals;" R. H. Cunningham, "The Restoration of Coordinate Power After Nerve Crossing;" R. H. Chittenden, "The Proteolytic Action of Papain;" C. F. Hodge, "Experiments on the Physiological Influence of Alcohol;" G. T. Kemp, "The Physiological Action of Nitrous Oxide;" S. J. Meltzer, "On Bactericidal Effects of Lymph from the Thoracic Duct" (with Dr. Charles Norris). G. W. Fitz, Demonstration of Apparatus: 1, A spring cylinder chronograph for spark records; 2, A lever system to illustrate the action of muscles in relation to joints; 3, A form of student's myograph; 4, A modification of the location reaction apparatus. C. F. Hodge (for C. C. Stewart), Demonstration of preparations of the nerve cell under acute alcoholic poisoning. General Business.

The American Morphological Society.—Boston, December 29, 1896.—The following papers were read: Arnold Graf, "On the Individuality of the Cell." Maintained the individuality of the cell pointing out the existence of organs in it. A. D. Mead, "On the Centrosomes of Chætopterus." Pointed out the existence of primary and secondary centrosomes in the unfertilized egg, the latter arising from the reticulum of the cytoplasm. These form the centers of spindles, and these spindles divide. History of the egg centrosome during maturation traced, and at the close of the formation of the second polar globule it occupied a position in center of chromosomes. Author was not certain of the origin of the male centrosome. F. R. Lillie, "Origin of the Center of the First Cleavage Spindle in Unio complanatus. This form is unlike Myzostoma in that it has male and female asters; but the centrosome of segmentation, like that of Myzostoma, arises from the female. E. B. Wilson, "Centrosome and Middle Piece in the Fertilization of the Egg." In Toxopneustes the centrosome arises not from the middle piece, but from a point between this and the head of the spermatozoan. H. E. Crampton, Jr., "Observations on the Fertilization in Gasteropods." Largely a confirmation of a paper by Mead. Miss Byrnes, "Maturation and Fertilization of Limax." C. S. Minot, "A New Microtome; New Laboratory Methods." Method of sharpening microtome knives—exhibited serial sections 2μ thick cut with the new microtome and with knives sharpened with adamantine by

a laboratory boy. He advised filtering of all waste paraffine in the laboratory. W. Patten, "Preservation of Cartilage, etc., in a Dry Condition." By impregnetion with paraffine as if for section work. C. B. Davenport, "The Role of Water in Growth." Careful weighing of frog embryos shows that in early stages increase in weight is almost entirely due to absorption of water. J. P. McMurrich, "Structure and Function of the Hind Gut of Isopods." This region is lined with solid chitinous intima; does not increase in number of cells; does not absorb food. Dr. Conklin contradicted this, claiming that the intima is traversed by fine canaliculi, that food is absorbed by this region, and that its cells divide in the length of the animal by amitosis.

December 30, 1896.—H. C. Bumpus, "The Result of the Suspension of Natural Selection as Illustrated by the Introduced English Sparrow." Showed by comparison of 1600 eggs that this bird is more variable in the United States than in England. G. W. Field, "The Plankton of Brackish Water." A. E. Verrill, "Nocturnal Protective Colors of Animals." On diurnal changes in colors of fishes as related to natural selection. Margaret Lewis, "Epidermal Sense-Organs in Certain Polychaetes." Structure and distribution of these in some maldanids. A. P. Henchman, "Eyes of Limax maximus." Details of structure and existence of primary and accessory visual organs. A. Schaper, "Earliest Differentiation of the Central Nervous System of Vertebrates." A history of the epithelial sustentation, glia and nerve cells in the spinal cord; and a parallel between ontogeny and the conditions found in amphroxus, lamprey, selachian, etc. W. Patten, "A Basis for a Theory of Color Perception." Based upon the wave lengths and the conical shape of the end-organs. N. P. Harrington, "A New Species of Entoconcha and the Systematic Position of the Genus." A. E. Verrill, "A Colossal Cephalopod from Florida." An octopus with body 18 feet long, 5 feet in diameter; estimated weight of this part, 5 tons. Part of one tentacle was found 34 feet long and 10 inches in diameter at the place where it was broken of. Its length in life is estimated between 70 and 90 feet. G. Lefevre, "Budding in Clavellinidæ." W. Patten, "Visual Centers of Vertebrates and Arthropods." An attempt to homologise these regions in the two groups. M. Bancroft, "Notes on Chelyosoma." J. S. Kingsley, "Amphiuma and the Caecilians." Claimed that these two forms are but remotely related to each other. F. C. Waite, "Brachial and Lumbo-Sacral Plexi in Necturus." The evidence presented by these structures upon vertebral intercalation and on the shifting of the pelvis.

The Society elected the following officers for the coming year: President, C. S. Minot; Vice-President, S. I. Smith; Secretary-Treasurer, G. H. Parker; Executive Committee, J. S. Kingsley, Bashford Dean. Many papers were left unread on account of lack of time. Probably, in the future, papers will be admitted only from actual members; they will be limited to fifteen minutes; and the authors will be requested to omit all historical reviews and details of observations, and to confine themselves to the broader conclusions and generalizations.

Boston Society of Natural History.—January 6, 1897.—The following papers were presented; Mr. A. W. Grabau, "The Sand Plains of Truro, Wellfleet and Eastham;" Prof. W. M. Davis, "A Geographical Classification of Coastal plains."—SAMUEL HENSHAW, *Secretary.*

January 20.—The following paper was read: Prof. W. O. Crosby, "The great fault and accompanying sandstone dikes of Ute Pass, Colorado."—SAMUEL HENSHAW, *Secretary.*

New York Academy of Science, Biological Section.—December 14, 1896, Prof. J. G. Curtis, Chairman, in the Chair. Dr. Arnold Graf made a preliminary report on "Some New Fixing Fluids;" Mr. J. A. McGregor read a paper entitled "An Embryo of *Cryptobranchus.*"

The embryo described is about 16 millimetres long, and is the first to be recorded of this species.

Prominent among its external features are the excessive amount of yolk, the marked ventral flexure in the cervical region, and the very early and almost simultaneous appearance of the two pairs of limbs. The dorsal surface is pigmented, the pigment cells being arranged in transverse bands, one band over each metamere of the body. Lateral line sense-organs can be distinguished. Among the most striking internal characters may be mentioned the dorso-ventral flattening of the notochord, the late appearance of entoderm and alimentary organs generally—due doubtless to the great mass of the yolk. The primordial skull is unusually well-developed. The auditory vesicle has an endolymphatic duct ending blindly immediately under the skin on the top of the head. Along the sides of the body a system of organs occur which are probably homologous with the embryonic sense-organs described by Beard in the sharks.

Dr. J. L. Wortman spoke of the "*Ganodonta,*" a new and primitive suborder of the Edentata from the Eocene of North America. One section or family of the suborder, viz., the Stylinodontidæ, is composed of *Hemigamus, Psittacotherium, Ectoganus* and *Stylinodon,* and

forms a closely connected and consecutive phylum, reaching from the base of the Puerco to the Bridger formation, and leading directly to the Gravigrada or ground sloths. A second family, viz., the *Conoryctidæ*, composed of *Conorycles* and *Onychodectes* may be regarded as ancestral to the Armadillos. The character and origin of the Edentate fauna of South America was discussed at length, and the conclusion reached that its original home was in North America. It was further held that there was a migration to the southward before the close of the Eocene, and that there must have then been an early land connection between the two continents.—C. L. BRISTOL, *Secretary.*

University of Pennsylvania Biological Club.—Monday, January 4th, Program. Demonstrations: "Descriptive Demonstration of the Life-History of Sacculina, H. Heath. Reviews: "Zoological," Drs. Moore and Calvert; "Chemical," Dr. Mary E. Pennington; "Pathological," Dr. Ferree Witmer; "Botanical," Dr. Macfarland, Mrs. Wilson. (Time limit for each review, five minutes.) Original Communication, by Dr. Edw. D. Cope, "The Embryonic Appendages and the Evolution of Mammalia."—H. C. PORTER, *Secretary.*

January 18.—Program Demonstration, Cell changes in Spirogyra grown under color-screens, Dr. Mary E. Pennington: Review.—Zoological: Dr. P. Calvert, Chemical; Dr. Mary E. Pennington, Botanical; Dr. J. Harshberger, Original Communications.—Account of the Boston meeting of the Society of American Naturalist and Affiliated Societies. Profs. Macfarlane, Conklin, Witmer, and Cope.—H. C. PORTER, *Secretary.*

The Biological Society of Washington.—January 2, 1897.—The following communications were made: "Brief Informal Notes and Exhibition of Specimens," (All the members are cordially invited to take part); E. W. Nelson, "New Birds from Mexico;" F. A. Lucas, "On the Natural Mortality Among Fur Seals;" C. Hart Merriam, "On the Pribilof Island Hair Seal;" W. H. Dall, "Notes on the Molluscan Fauna of the Pribilof Islands."—FREDERICK A. LUCAS, *Secretary.*

January 16.—The following communications were made: David White, "A New Lycopodineous Cone from the Coal Measures of Missouri;" David White, "Unity or Plurality of Type Specimens in Paleontology;" Edward L. Greene, "Development of the Idea of a Genus;" M. A. Carleton, "Ontogenetic Separation of *Puccinia graminis avenæ* from *P. graminis tritici.*"—FREDERIC A. LUCAS, *Secretary.*

Cincinnati Society of Natural History.—At the monthly meeting, January 5, 1897, the following communications were made: "On the Pulsation of the Molluscan Heart," by Frank C. Baker, of Chicago; "Catalogue of the Odonata of Ohio—Part III," by D. L. Kellicott, of Columbus, O.; "An Odonate Nymph from a Thermal Spring," by the same author. (All three papers will be published in the "Journal" of the Society.—JOSUA LINDAHL.

The Academy of Science of St. Louis.—At the meeting of the Academy of Science of St. Louis, on the evening of December 21, 1896, Mr. H. von Schrenk made some remarks on the parasitism of lichens, illustrated especially by the long hanging forms of *Usnea barbata*, common on Juniperus, etc., on Long Island, N. Y. It was shown that these lichens do not penetrate below the outer periderm of the host, and consequently are not to be regarded as true parasites, but that they frequently cause the death of the latter by suffocation. As Schimper has noted for the long moss of the South, *Tillandsia usneoides*, the plant is capable of dissemination by wind and birds, and of growing in new stations without attachment. Officers for 1897 were nominated.

January 4, 1897, Dr. Amand Ravold gave a microscopic demonstration of Widal's test for typhoid fever, demonstrating that after the disease has existed for four days or more the blood of typhoid patients, probably because of some contained antitoxine, possesses the power of inhibiting the motion of typhoid bacilli from a pure culture introduced into it within a period of one hour or less, whereas in normal blood similar bacilli retain their power of locomotion for an indefinite length of time. It was stated that typhoid blood possessed this property even after having been dried for a period of four weeks or more, so that a few drops obtained from a person suspected of having the disease may be sent to suitable places for applying the test, thus rendering comparatively easy the early diagnosis of a disease, which, in its early stages, presents many clinical difficulties.

Professor F. E. Nipher gave preliminary results of partially completed experiments, made through the courtesy of the Burlington and Illinois Central Railroads, to determine the frictional effect of trains of cars on the air near them. His apparatus consists of a cup collector supported on a bar capable of sliding in guides on a clamp attached to the window-sill of the car. The bar is thrust out to varying distances up to 30 inches. The mouth of the collector is turned in the direction of motion of the train. The pressure due to the motion is conveyed through a rubber tube attached to the rear of the collector, and passing

lengthwise through the car to a water monometer. The monometer has a tube with a rise of 4 or 5 in 400, and is provided with a pivotal mounting and a level.

The pressure near the train is comparatively small, and increases as the collector is thrust further out. It approaches a limit corresponding to the train velocity at the instant. Professor Nipher finds the relation between the limiting pressure and velocity to agree exactly with the formula $P=\frac{S}{2}v^2$, where v is the train velocity in centimeters per second, P is the pressure in dynes to the square centimeter, and S is the density of air in C. G. units at the temperature and pressure of the observations. He finds the pressure a maximum when the axis of the collector is parallel to the direction of motion with the mouth to the wind. Turning the collector until the axis makes an angle of about 80° with this position, the pressure reduces to zero. At greater angles the pressure becomes less than atmospheric pressure by an amount which reaches a maximum at the angle of 90°, and passes through a minimum at an angle of 80°, when the collector is in a trailing position. The sum of the coefficients for the two positions of maximum compression and minimum exhaust is almost exactly the same as Langley obtained with a pressure board when exposed normally to the wind.

The result shows that a large amount of air is dragged along with the train, the motion being communicated to air many feet away. This air is a source of danger to one standing too near the train when at full speed. One is likely to be toppled over, and the blow of the air communicates a motion of rotation, which may cause one to roll under the train if the nature of the ground does not prevent such a result. It was remarked, however, that where trains have a right to run at any speed, no prudent person would stand so near to a train as is necessary in order to be in danger from this source.

The following officers were declared elected for the year 1897: President, M. L. Gray; First Vice-President, E. A. Englar; Second Vice-President, Charles R. Sanger; Recording Secretary, William Trealease; Corresponding Secretary, F. C. Runge; Treasurer, Enno Sander; Librarian, G. Hambach; Curators, Julius Hurter, J. H. Kinealy, E. Evers; Directors, M. H. Post, Joseph Grindon.

One person was elected to active membership.—WILLIAM TREALEASE, *Recording Secretary.*

Nebraska Academy of Sciences.—The Seventh Annual Meeting was held at Lincoln, December 29, 1896, with the following program:

Presidential Address by Prof. E. H. Barbour on "Academies of Sciences, their Economic and Educational Value," with suggestions for the improvement of our Academy; "A New Plankton Pump" for collecting aquatic organisms from any desired depth, H. B. Ward and Charles Fordyce; "Continued Biological Investigations," H. B. Ward; "Progress in the Study of the Fauna of the State" showing the richness of our fauna and how little it is known, Lawrence Brunner; "Some Methods of Collecting, Preserving and Mounting Fossils," Carrie A. Barbour; "Nomenclature of Nebraska Trees" with the history of particular names, Charles E. Bessey; "Reflections on the Genus *Ribes*" importance of recognizing the validity of species created by the gardener, F. W. Card; "Chalcedony-lime Nuts of the Genus *Hickora* from the Bad Lands of Nebraska," E. H. Barbour; "Comparison between Nebraska Diatomaceous Earth and that from Neighboring States," C. J. Elmore; "What is Mathematics" and how it correlates other sciences, E. W. Davis; "A Family of Quartic Surfaces," the sum of the distances of whose locus from two given surfaces is constant, Robert E. Moritz; "A Form of Weir Notch," giving a flow of water varying directly as the head, instead of following the usual more complicated law, O. V. P. Stout; "An Observation on Annual Rings in Tree Growth" when complete defoliation did not induce the growth of a second ring, F. W. Card; "Internal Temperature of Trees" rising as high as 119° at a depth of half an inch in a trunk exposed to sunshine, R. A. Emerson. The remaining papers, owing to the lateness of the hour were read by title only, as follows: "Notice of Two Important Books on Systematic Botany," Charles E. Bessey; "The Barites of Eastern Nebraska and the Bad Lands," Erwin H. Barbour; "Some Data as to Wind Distribution of Seeds," Ed. M. Hussong; "Parasites of Nebraska Dogs," Henry B. Ward; "Discovery of the First Meteorite in Nebraska," Erwin H. Barbour; "Notes on Phyllopod Crustacea," H. A. Lafler and A. S. Pearse.

The following officers were elected: President, Dr. A. S. Von Mansfelde; Vice-President, Dr. E. H. Barbour; Secretary and Treasurer, Prof. G. D. Swezey; Custodian, Prof. Lawrence Bruner; Directors, Dr. H. B. Ward, Prof. H. B. Duncanson, Mr. C. J. Elmore and Dr. H. Hapeman.

The next Annual Meeting will be held on the day following Thanksgiving. The volume of Proceedings for 1894–1895 has just been issued, price 40 cents.—G. D. SWEZEY, *Secretary.*

The Botanical Seminar of the University of Nebraska.—December 5, 1896.—The following papers were presented: Mycolog-

ical Statistics of Nebraska, Mr. Roscoe Pound; The Comparative Anatomy of the Pistil in Apocarpous Families, Mr. Ernst Bessey: Phytogeographical Notes from Colorado, Mr. C. L. Shear. December 26th.—The Polyphylesis of the Lichens, Mr. F. E. Clements; The Phytogeography of Nebraska, Mr. Roscoe Pound: The Flora of Roberts County, South Dakota, Prof. D. A. Saunders; Washington and its Botanists, Mr. A. F. Woods.

Botanical Seminar of the City of Washington, D. C.—December 12, 1896.—The following papers were presented: Short Notices of Current Literature; Synopsis of the Genus Chætochloa, J. G. Smith; The Origin and Development of Sexuality and Alternation of Generations, Considered from the Modern Cytological Standpoint, W. T. Swingle; Some Cases of Polyembryony, A. J. Pieters; Manufacture of Cereal Foods, Mr. A. Carleton.

Torrey Botanical Club.—At the meeting of Tuesday evening, December 8, 1896, thirty persons were present and one new active and seven corresponding members were elected. The death of Mr. Wm. H. Rudkin, one of the oldest members of the club, was announced by Dr. Britton, and a committee was appointed to take suitable action. It was resolved that a complete list of the corresponding members should be printed in the December number of the *Bulletin*. A contribution by Dr. T. F. Allen, entitled "Descriptions of New Species of *Nitella* from North America and Japan," was read by title by Dr. Britton in the absence of the author. Mrs. Elizabeth G. Britton presented a "Contribution to the Bryology of Bolivia." It reviewed the more important collections of Bolivian mosses, the treatment which they had received and the present work in progress on this subject, and enumerated the bryological collections made by Dr. Rusby in Bolivia in the years 1885 and 1886. This collection contained 96 species, in 39 genera, 42 of the species being hitherto undescribed. Dr. H. H. Rusby spoke of "Botany at the Pan-American Medical Congress held in the City of Mexico, November, 1896." This paper contained brief references to the character of the flora observed on the journey to Mexico, an account of the scientific progress in the city, especially pertaining to applied botany and referred to the botanical work organized by the Pan-American Medical Congress. It was supplemented by remarks upon the same subject by Mrs. Britton, who also attended the Congress. A number of important publications by the *Instituto Medico Nacional* were exhibited. Dr. N. L. Britton described a new species of Geranium hitherto confounded with *G. Carolinianum*. The papers by Dr.

Allen and Dr. and Mrs. Britton will be published in the *Bulletin*, that by Dr. Rusby in the *Druggists' Circular*. On motion the Club adjourned to meet on the second Tuesday in January.

H. H. Rusby, *Rec. Secretary.*

Chicago Academy of Sciences.—A regular meeting of the Academy of Sciences was held Tuesday evening, December 22, 1896. Prof. Willis L. Moore was elected a corresponding member. Mr. Frank M. Woodruff, Ornithologist of the Academy, read a paper on "*Recent Occurrences of Rare Birds in Chicago.*"

The speaker remarked that he had been collecting data and specimens during the past year for the Ornithological Report of the Geological and Natural History Survey, and had been fortunate enough while engaged in this work to run across a number of rare species. The most favorable time for collecting these rarities is when Lake Michigan is almost frozen over, or during the months of January and February, after the wind has changed from an easterly direction and is blowing from the west. The east wind breaks up the ice and the west wind drives the broken floes away from the shore, leaving at times a long stretch of clear water, with here and there a small patch of ice; in this open water the ducks and gulls gather by thousands to feed upon dead fish and sewerage, and they may then be collected very readily. Many of the birds gathering here at this time are inhabitants of Alaska and Northern British America.

The rarest bird taken was a specimen of an immature male Kittiwake Gull (*Rissa tridactyla*) which was shot by Mr. Wagner on the 9th of December near Lincoln Park. This is the first record of a specimen of this bird being shot in Illinois. Barrows Golden-eye (*Glaucinetta islandica*) was seen recently in large flocks, and two specimens were shot, one of which got away, but the other was captured and is now in the Academy's collection. This species is rare, and there are but few records of its capture. The Old Squaw (*Claugula hiemalis*) is seen commonly about Chicago, but is seldom taken. Mr. Woodruff mentioned the following additional more or less rare species: White-winged Scoter (*Oidemia deglandi*); Velvet Scoter (*O. fusca*, at Meredosia); Robin Snipe or Knot (*Tringa canutus*); Buff-breasted Sandpiper (*Tryngites subruficollis*); Baird's Sandpiper (*Tringa bairdii*); Piping Plover (*Ægialitis meloda*); Black-bellied Plover (*Charadrius squatarola*); Stilt Sandpiper (*Micropalama himantopus*); Willet (*Symphemia semipalmata*); Turnstone (*Arenaria interpres*); Harlan's Hawk (*Buteo borealis harlani*) and American Goshawk (*Accipiter atricapillus*). The

Little Yellow Rail (*Porzana noveboracensis*) was mentioned, not as being rare, but as seldom collected, probably on account of its small size and skulking disposition.

The paper was illustrated by specimens of the species spoken of belonging to the Academy and Mr. Woodruff.

FRANK C. BAKER, *Secretary.*

SCIENTIFIC NEWS.

It will be of interest to Botanists and Zoologists to learn that a Biological Survey of Alabama has been organized and put into operation. The Survey will be carried on under the auspices of the Alabama Polytechnic Institute, and will be named by the specialists engaged at that institution in the various lines of biological investigation. It will have for its object the study in field and laboratory of all plants and animals occurring in the state and of the various conditions effecting them. The work will be done systematically and thoroughly and all results published. In a region so interesting and little worked as this portion of the Southern United States, careful and extended research will be sure to yield results of the greatest value. Large quantities of material in all groups of plants and animals (especially insects) will be collected and properly prepared. In connection with the Survey there has been founded an Exchange Bureau, from which will be distributed all duplicate material. Anyone desiring to correspond relative to specimens, literature, or work of Survey, should address *The Alabama Biological Survey, Auburn, Alabama.*

The New Monthly Open Court.—With January, 1897, the Chicago *Open Court* celebrates the decennial anniversary of its nativity and more consonantly with the solid character of its contents now appears in the form of a monthly instead of a weekly. Undoubtedly this change will gain more than ever the attention of thoughtful people for *The Open Court,* which is devoted to the high ideal of purifying religion by the methods employed in science,—an aim which it has always reverently but fearlessly pursued.

In the ten years of its existence *The Open Court* has gained the hearty co-operation of a majority of the world's most eminent scientists and thinkers, both orthodox and unorthodox. The subscription-price

to *The Open Court* being reduced to an absolute minimum, its work has been rendered possible only by the large private endowments of Mr. E. C. Hegeler of La Salle, whose contributions to its support have exceeded its net income by ninety-six per cent.

In the present opening number besides the Salutatory of the editor expounding the purpose of *The Open Court*, is an extremely significant controversy on Buddhism and Christianity between the Right Rev. Shaku Soyen, delegate of Japan to the Chicago Parliament of Religions, the Rev. Dr. John Henry Barrows, Chairman of the Parliament, and the Rev. F. F. Ellinwood, a prominent Presbyterian clergyman of New York,—a literary symposium realising the idea of a Parliament of Religions extension. A powerful sermon on "Trade and Usury" by Martin Luther, skilfully translated by Professor Carruth, a valiant defence of the claims of Science in Theology by Dr. Cornill, Professor of Old Testament history in Königsberg, Germany, Notes and Reviews of important books complete the contents. With the promise of the first number and its old reputation, *The Open Court* is assured of increased and abiding success. (Annual subscription, $1.00: The Open Court Publishing Co., Chicago.)

Mr. Herbert Spencer.—Mr. F. H. Collins, of Edgbaston, forwards an address of congratulation to Mr. Herbert Spencer upon the completion of his "System of Synthetic Philosophy," signed by more than 80 noblemen and gentlemen eminent in public life, in literature, and in various branches of learning and science. The signatories request Mr. Spencer to permit them to employ some eminent artist to take his portrait, with a view to its being deposited in one of our national collections. Mr. Spencer, in a letter to Sir Joseph Hooker, complies with the request thus made, explaining the reasons which formerly led him to refuse a similar proposal. Mr. Herkomer, R. A., has undertaken to paint the portrait.